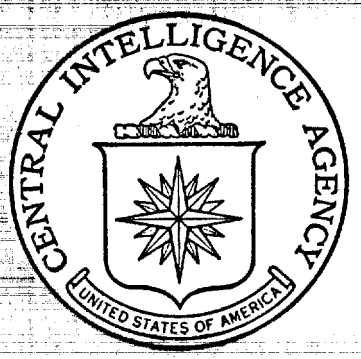
PROVISIONAL INTELLIGENCE REPORT

MANGANESE IN THE SOVIET BLOC



CIA/RR PR-94
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CIA/RR PR-94

(ORR Project 23.173)

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MANGANESE IN THE SOVIET BLOC*

Summary

Manganese is an essential component in the production of iron and steel and is therefore a basic element in an industrial economy. Manganese ore with a relatively low metallic manganese (Mn) content is used in the production of pig iron and foundry iron. Metallurgical-grade manganese ore -- ore with a Mn content of over 46 percent -- is desired for the manufacture of ferromanganese, which is used in the steel-making process. A small amount of very high-grade ore is used for special purposes, principally the manufacture of dry-cell batteries.

The manganese ore reserves of the Soviet Bloc are estimated at 872 million metric tons.** Of this total the USSR has 93.6 percent, Communist China has 3.7 percent, Hungary has 2.2 percent, and Rumania has 0.5 percent. Czechoslovakia, Bulgaria, and Albania have small deposits, but quantitative estimates cannot be made. Poland and East Germany have no reserves.

Of the total manganese ore reserves of 816 million tons in the USSR, about 296 million tons are classified as "proven." These proven reserves, approximately one-half of the total world supply, are adequate for any forseeable long-term requirements of the iron and steel industry of the Soviet Bloc.

About 90 percent of the proven reserves in the USSR is in two deposits -- at Nikopol', in the Ukraine, and at Chiatura, in Georgia -- which accounted for about 75 percent of total 1953 production in the Soviet Bloc. Total Soviet Bloc production is estimated at about 5.5 million tons of manganese ore. The USSR produced about 90 percent of this total; Czechoslovakia, about 4 percent; China, about 2 percent; and Hungary, Rumania, and Bulgaria accounted for the remainder about equally.***

Prior to World War II the USSR was the world's largest exporter of manganese ore. In the early postwar years the USSR attempted to regain its export market and in 1948 exported to non-Soviet countries a

* The estimates and conclusions contained in this report represent the best judgment of the responsible analyst as of 23 September 1954.
** Throughout this report, tonnages are given in metric tons.
*** A map showing the principal manganese deposits in the Soviet Bloc will be found inside back cover.

total of about 420,000 tons. A shift in Soviet policy, however, coupled with Western trade restriction, reduced exports, and in 1951 the USSR exported only about 51,000 tons. Trade agreements now in effect indicate that in 1954 the USSR will export about 255,000 tons to non-Bloc countries -- not enough to have a significant effect on total Bloc supply.

Intra-Soviet Bloc trade in manganese ore is largely a matter of Soviet shipments to other Bloc countries. East Germany, Poland, and Czechoslovakia are the major importers. It is estimated that in 1953 about 447,000 tons of Soviet ore were shipped to these countries. Although Communist China exports a part of its production of manganese ore, it imports from the USSR part of the ferromanganese requirements of its steel industry.

Total consumption of manganese ore in the Soviet Bloc in 1953 is estimated at 3.7 million tons. The USSR consumed about 3.3 million tons of this total. Of the Soviet consumption, about 40,000 tons were used in the chemicals industries and all the rest in the iron and steel industry. Czechoslovakia, Poland, and East Germany were the largest consumers of manganese ore among the European Satellites in 1953. Czechoslovakia consumed about 367,000 tons, Poland about 186,000 tons, and East Germany about 112,000 tons. Total consumption in Communist China was about 80,000 tons.

A comparison of total Soviet Bloc supply of manganese ore with total consumption indicates that in 1953 there was a Bloc surplus of about 1.5 million tons. Although there is no firm evidence of a major manganese ore stockpiling program in the Soviet Bloc, it is logical to assume that such a program exists.

The manganese ore industry of the Soviet Bloc is quite capable of meeting the requirements of an expanding iron and steel industry. Reserves are adequate, and production facilities are improving. It is likely that production goals will be met and that by the end of 1955 the USSR alone will be producing at the rate of about 6 million tons annually.

The possible vulnerabilities of the manganese ore industry in the Soviet Bloc lie in the concentration of production facilities at Chiatura and Nikopol' and in the dependence of the iron and steel industries of the European Satellites on supplies of Soviet manganese ore.

I. Introduction.

Of all the critical minerals, manganese is often referred to as the most important; without it no steel can be produced. It is the sixteenth most common element in the earth's crust, and it is widely distributed in the USSR. Because of its high affinity for oxygen, it most often occurs as part of an oxide mineral and frequently in either a silicate or carbonate.

Manganese (Mn) is a gray, hard, brittle, lustrous metal, in most respects resembling iron, both physically and chemically. Its specific gravity is 7.4, and its melting point is 2268° F (1242° C). One of the outstanding characteristics of manganese is that in its most common uses the metal is dissipated in a form not susceptible to subsequent recovery as secondary metal. The result is that almost all requirements for each year must be met from new production. A prominent feature of the production of manganese is that little is produced in the form of pure metal, most of it being converted from ore into the intermediate forms of ferroalloys or spiegeleisen* and used in the treatment of iron and steel and in the production of alloyed materials. The small proportion converted into more or less pure metal does not go into use in the pure form but is used in making various nonferrous alloys.

Only a few of the 125 minerals of manganese have economic importance. Classification, composition, and manganese content of these are as follows:

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* Spiegeleisen denotes a ferromanganese alloy having a manganese content of from 10 to 25 percent.

Mineral	Composition	Mn Percent
Pyrolusite (black oxide of manganese)	MnO_2	63
Psilomelane (manganese hydrate)	$MnO\ MnO_2\ 2H_2O$	45 to 60
Wad (manganese and other oxides)	Hydrous Mn Oxide	Variable
Manganite (hydrate manganese oxide)	$Mn_2O_3H_2O$	62.4
Hausmannite	Mn_3O_4	72.5
Braunite	$Mn_2Si_2O_3$	69
Rhodochrosite (manganese carbonate)	$MnCO_3$	47.5
Rhodonite (manganese silicate)	$MnSiO_3$	42
Bementite	$2MnSiO3H_2O$	39

Psilomelane, pyrolusite, wad, and braunite occur in nature much more frequently than the other manganese minerals.

Commercial ores of manganese are grouped into the following classes according to the chemical composition needed for major end uses:

Class of Ore	Content
Chemical Grade (includes battery ores)	82 to 87 percent MnO_2
Ferro-grade (metallurgical ores)	Over 46 percent Mn
Ferruginous Manganese Ore (spiegel and pig iron ores)	10 to 35 percent Mn
Manganiferous Iron Ore (pig iron ores)	5 to 10 percent Mn

The iron and steel industry accounts for approximately 95 percent of the total consumption of manganese, the balance being consumed by the nonferrous metals industry and by the chemical industry. In the making of pig iron and steel, manganese assumes the role of a de-oxidizer and de-sulfurizer. For this purpose there is no known substitute. It also is used as an alloy constituent in the production of steel.

When used in the manufacture of pig iron, manganese is included in the blast-furnace burden in the form of ore. Low-grade manganese ores (usually less than 30 percent Mn), which cannot be beneficiated economically for use in smelting ferromanganese alloys, are suitable for this practice.

Manganese ores used for steel are normally smelted into a ferromanganese alloy (spiegeleisen or ferromanganese) or a ferromanganese alloy that also includes silicon (silicospiegel or silicomanganese). It is in these forms that manganese is added in the steel-making process. Metallurgical-grade ores or concentrates containing more than 46 percent manganese are preferred for making ferromanganese, but ores of lower manganese content can be used for the other alloys. By the exact regulation of the additions of these and other alloys to steel, a range of desired qualities of hardness, toughness, forgeability, and wear resistance can be derived. When manganese is used in large quantities as an alloy, making up 7 to 15 percent of the finished steel, the result is one of the "toughest" metals known. Manganese steel goes into power-shovel teeth, railroad frog switches, crushing machinery, and other products which are subject to heavy shock and abrasion. Hadfield steel, a high-manganese, high-carbon alloy, is used in large quantities for steel helmets and other armor applications.

Without manganese, no nation could possibly produce the type of armaments required by modern warfare. The possession of huge reserves of manganese ore is one advantage which the USSR enjoys over the US, which has to import 90 percent of its requirements. Soviet specifications for both manganese end products and ores are given in Appendix A.

The chemical uses of manganese are comparatively small but are of importance far beyond their bulk. The chief demand is for a high-grade manganese dioxide ore, with a minimum of iron and other harmful impurities, for use as a depolarizer in the manufacture of dry-cell batteries. Other users of manganese for chemical purposes are the glass, ceramic, paint, photographic, and pharmaceutical industries.

When manganese is alloyed with nonferrous metals such as aluminum, magnesium, bronze, and the like, it is normally added in the form of manganese metal. A relatively small amount of manganese adds hardness and stiffness to these metals.

In the important role of alloying, the same effects accomplished by manganese are not obtainable by using other metals in some alloys. On the other hand, there are metallurgical applications where manganese and other metals may be interchanged, but not always to the same degree. The USSR has large manganese reserves, and any substitution will involve manganese for other metals rather than the reverse.

Detailed descriptions of the geology, character of the ore, methods of working, types of equipment, methods of concentration, amount of ore produced, transportation facilities, labor employed, and the like, when available, were made a part of this supply but are not reproduced here; they may be obtained in typescript by authorized persons.

II. USSR.

A. Development of the Industry.

The Chiatura manganese deposits in the Russian Caucasus 1/* and the Nikopol' deposits in the Ukraine, 2/ both exploited before 1900, accounted for more than half of the world's production of manganese in the period before World War I (54 percent in 1913). The ratio fell to 1 percent in 1921, but in the following years increased steadily, reaching 38 percent in 1926. That year production totaled 1,334,000 tons, compared with the prewar high of 1,245,000 tons produced in 1913. 3/

Before the expansion of the Soviet steel industry, manganese ore was mined principally for export. Between 1928 and 1932, almost 70 percent of production was exported, and in 1931, exports reached 84 percent of domestic production. During the Second Five Year Plan (1933-37), exports were larger in volume but constituted a smaller percentage of domestic production. 4/

Manganese ore mining outside of the Chiatura and Nikopol' areas was insignificant until 1933. In order to eliminate the long hauls to the new steel plants in the Urals and Siberia from Chiatura in the Transcaucasus and from Nikopol' in the Ukraine, plans were made for developing manganese ore deposits in these latter areas. With the invasion of the Ukraine by the Germans in 1941, great emphasis was put on the Urals and Siberian deposits to fill the production gap brought about by the loss of Nikopol' and by the vulnerable long haul from Chiatura.

Postwar plans have called for greater expansion of the manganese industry by continued exploration of known deposits and for discovery of new deposits. New technological improvements in mining and processing the ore are being utilized to increase production.

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* Footnote references in arabic numerals are to sources listed in Appendix D.

B. Organization of the Industry in the USSR.

The manganese ore industry of the USSR is under the jurisdictional control of the Ministry of Ferrous Metallurgy and is directly subordinated to the Administration of Ore Mining, which controls all research and planning. The organizational structure of the industry* is shown on the accompanying chart.**

C. Resources.

The USSR is the only major steel producer in the world having adequate domestic manganese reserves. Nearly one-half of the world's "proven" reserves are located within its geographical boundaries.

Depletion as a result of past production of manganese ore for export and for consumption has been more than offset by discoveries of new ore bodies. Instead of diminishing, the known reserves have increased by these new discoveries and by the development of methods for the utilization of lower grade ores.

Since 1938, in keeping with the policy of maintaining secrecy in regard to critical raw materials, no complete statistical data concerning the amounts of reserves, production, consumption, or export of manganese ore have been published. Fortunately sufficient data are available for the estimation of the USSR's manganese reserves within a small margin of error.

Probably the most detailed and complete description of the USSR's manganese deposits and reserves is a 1935 compilation, which estimated reserves at 650 million tons. 6/ Recent estimates by Western authors in two reports, "The World's Manganese Ores" 7/ and Die Bergwirtschaft der Erde, 8/ arrived at approximately the same total as the 1935 Soviet report.

In 1938, the Soviet State Planning Commission revised estimated total reserves to 785 million tons, 135 million tons greater than the

* The Dzhezdy manganese deposit in Kazakhstan is officially known as the Dzhezdy Manganese Ore Administration, but its position on the organizational chart is not known. The organizational structure of the less important manganese deposits in the USSR is also unknown.
** Following p. 8.

1935 estimate. Classification* of estimated manganese reserves in the USSR as of 1 January 1954 is shown in Table 1.

Table 1

Estimated Reserves of Manganese Ore in the USSR a/
1 January 1954 b/

Thousand Metric Tons

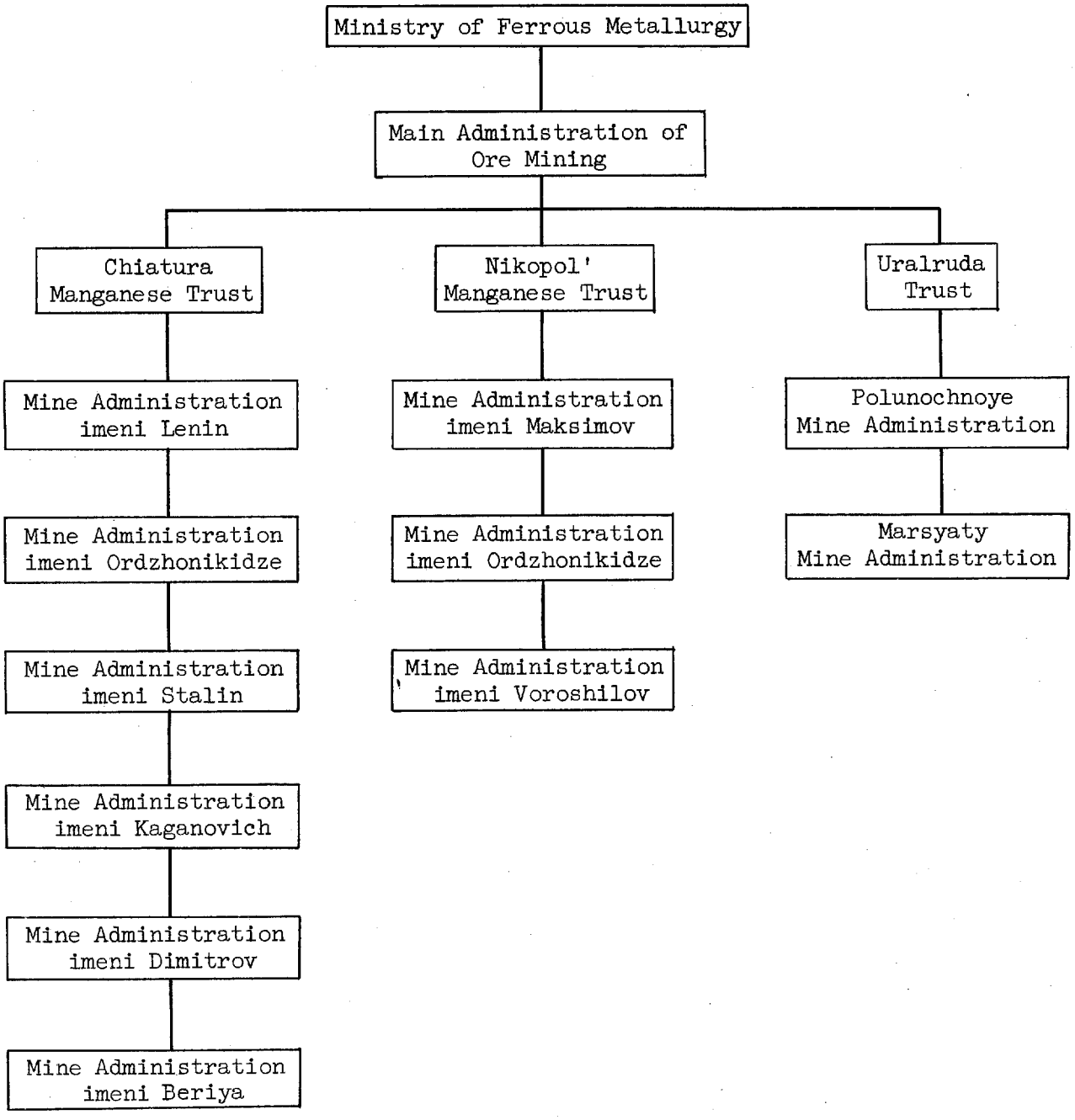
Economic Region c/	Proven	Probable and Possible	Total
Ukraine (Region III)	138,092	370,000	508,092
Transcaucasus (Region V)	151,474	32,660	184,134 d/
Urals (Region VIII)	N.A.	24,000 e/	24,000
Kazakhstan (Region Xa)	6,500	33,000	39,500
West and East Siberia (Regions IX and XI)	N.A.	60,000	60,000
Soviet Far East (Region XII)	10	100	110
Total	296,076	519,760	815,836

a. Metallic content of these reserves is discussed in the following pages.
b. See Appendix B, Methodology.
c. The term region in this report refers to the economic regions defined and numbered on CIA Map 12048.1, 9-51 (First Revision, 7-52), USSR: Economic Regions.
d. Chiatura carbonate ores are not included.
e. Sources indicate a range between 13 million and 35 million tons.

* Included in the "Proven" category are deposits covered in Soviet usage by the classifications "Groups A and B." A is subdivided into classes A_1 and A_2. A_1 denotes reserves which have been contoured by drilling and prepared for extraction. A_2 denotes completely prospected reserves capable of serving as a base for projected enterprises. Reserves in class B are those which have not been fully prospected, but, like A_2 reserves, may serve as a base for projected enterprises. Included in the "Probable and Possible" category are deposits covered in Soviet usage by the classifications "Group C_1 and C_2". Group C_1 denotes reserves immediately beyond the contour limits of Class B which may serve as a base for long-range, industrial planning. Group C_2 denotes reserves calculated on the basis of geological estimates for whole regions.

S-E-C-R-E-T

ORGANIZATIONAL STRUCTURE OF THE SOVIET MANGANESE INDUSTRY



S-E-C-R-E-T

1. Ukraine and Transcausus (Regions III and V).

Most of the USSR's manganese ore reserves are contained in two deposits, Nikopol' in the Ukraine and Chiatura in Georgia. Combined reserves of the two regions equal 90 percent of the USSR total.

The Chiatura manganese deposits, located on the southern slope of the Causcasus Mountains, are transversed by the Kvirila River and occupy an area of about 130 square kilometers. High-quality ore consisting of pyrolusite, psilomelane, manganite, braunite, and wad, make these deposits the most important in the USSR. The raw ore, containing 25 to 47 percent manganese, concentrates to as high as 55 percent. The high ratio of manganese to iron in the ore makes it possible to smelt ferromanganese with a high manganese content. Deficiencies of the ore are its high silica and phosphorous content. In addition to metallurgical-grade ores, chemical-grade ores containing 70 to 80 percent manganese dioxide are found.

The Nikopol' deposits, the world's largest known single concentration of manganese ore, lie on the right bank of the Dnieper River, northwest and northeast of the town of Nikopol' in the Dnepropetrovsk Oblast, Ukrainian SSR, and cover an area of 275 square kilometers. Mineralogically, the ore consists of pyrolusite with an admixture of psilomelane and bog manganese. The manganese content averages 28 percent, and the silica content attains a value of 42 percent, which requires the extracted ore to be washed. The ratio of manganese to iron is about 10 to 1. Phosphorous content, which is normally higher than in Chiatura ores, ranges between 0.20 and 0.27 percent. Despite the fact that the Nikopol' Basin has been worked for more than 50 years, many sectors of the deposits have not been sufficiently explored.

During the Fourth Five Year Plan (1946-50), the USSR sought to establish the availability of a new 100-million-ton industrial reserve -- 70 million tons at Nikopol' and 30 million tons at Chiatura. 9/ Because of favorable geology in both of these areas, it is believed that the project was successful and that a total of 100 million tons of ore previously classified as "probable and possible" reserves was established as "proven."

2. Urals (Region VIII).

Exploratory work has revealed more than 200 manganese deposits in the Urals. They are, with a few exceptions, not large and have a relatively low manganese content, but they have the great advantage

of being located near metallurgical plants. Emphasis on their development has been stressed since the beginning of World War II, but geological exploration has failed to uncover important reserves of metallurgical-grade ores.

Prewar manganese resources of the Urals were estimated to range from 13 million to 35 million tons of all classes of ore. Manganese content ranges from 20 to 30 percent. Among the numerous deposits of the Urals, two groups are outstanding: the northern, Polunochnoye-Marsyaty group, in Sverdlovsk Oblast RSFSR; and the southern, Uchalinsk-Abselilovo-Baymak group, in Bashkir ASSR. In the Central Urals, between Kushva and Sverdlovsk, there are a number of other deposits which are of minor importance. Deposits are also known to exist in the western foothills of Udmurt ASSR.

Huge quantities of mineralized jasperites are found on the southern slopes of the Ural Mountains and some day may become a source of ore for Eastern metallurgy.* These low-grade manganese ores have not been included in the ore reserve analysis, as they have never been surveyed for quantity.

3. Central Asia (Region X).

The existence of major manganese deposits in the remote desert areas of Kazakhstan was established as early as 1932. Deposits of considerable industrial importance were found at Dzhezdy, Nayzatas, Kara-Dzhal, Ktay, Klych, and Shoyntas. The existence of manganese ores on the Mangyshlak Peninsula has been known for a greater period, but because of their remote location and low manganese content (22 percent Mn), there has been little development.

In 1938, manganese ore reserves of Kazakhstan totaled 36 million tons. Although the greatest portion of the reserves are found on the Mangyshlak Peninsula, the most important production is taking place at deposits located in the Karaganda Oblast. Of these the Dzhezdy deposits

* Mineralized jasperite, a complex ore with low manganese content, is comparable to iron taconites in the US or the iron quartzites of the USSR, in the sense that liberation of the manganese from the associated materials will require huge investments in beneficiation equipment. As far as can be ascertained, the USSR has expended little effort toward their utilization.

are receiving the greatest attention. Mapping of the Karaganda deposits is still in progress, and thus far 6.5 million tons of "proven" reserves of metallurgical-grade ores have been established. 10/ Wartime developments intensified the development of Kazahkstan ores, which are increasingly filling the needs of the Urals iron and steel plants.

Following World War II, manganese ore was first reported in East Kazakhstan, near the towns of Belunskoye Ust'-Kamenogorsk, and Ol'ginskoye. If these reports are authentic, a new source of manganese ore may exist for the iron and steel plants of the Kuznetsk Basin. Mine production is reportedly taking place, but other than this, no information regarding the deposits is available.

4. Siberia (Regions IX and XI).

Geological exploration is still insufficient to permit final judgment of the relative availability of metallurgical-grade ore in the largest part of the USSR. Efforts to improve this situation were stipulated in the 1946-50 Plan, which called for the expansion of prospecting operations, particularly in the eastern areas, with the object of discovering 1.5 billion tons of iron ore and 110 million tons of manganese ore. 11/

The only deposit now being worked in this area of industrial importance is the Mazul deposit, near the city of Achinsk. It supplies low-grade manganese ore to the iron and steel plants of the Kuznetsk Basin. "Proven" reserves of Mazul were estimated at just under a million tons in 1938, and the estimate was later increased. All of the ore is low grade, averaging 18 percent Mn, 16 percent Fe, and 0.3 percent P, and is not suitable for beneficiation. 12/ Utilization of the ore is limited to the smelting of pig iron at Stalinsk, the location of the only blast furnaces in Siberia.

Although there have been no official reports confirming new ore discoveries in the Mazul area, a report stating that Mazul was being "reconstructed" may imply the discovery of a new ore body and that it was being prepared for exploitation. 13/ The geology of the area is favorable in this respect, but because of the consistently low quality of the ore it is questionable that new discoveries would increase the importance of the deposits.

A potential source of manganese ore in this area depends on the ultimate development of the Usinsk deposit, a large carbonaceous manganese ore deposit discovered near the mouth of the Usa River,

approximately 70 to 80 kilometers east of Stalinsk. 14/ Outcroppings were first reported in 1931, but little exploration was done until the mid-1940's. Preliminary examinations revealed that the ore body contains up to 60 million tons of ore with a manganese content up to 25 percent. Soviet authorities report that this 60 million tons constitutes only part of the deposit. 15/

The deposit, located in wild taiga country, cannot be exploited fully until completion of the Stalinsk-to-Abakan link of the South Siberian Railroad. 16/ This section forms the last link, which will connect Magnitogorsk to Abakan. Construction of the South Siberian Railroad has encountered many difficulties, but it is believed that sufficient progress has been made east from Stalinsk that it is now possible to connect the deposit to the main line by a spur. Importance of the Usinsk project to the Siberian iron and steel industry should put its development high on the Soviet priority list of planned projects.

Gravitational concentration tests of Usinsk ores have proved unfavorable. 17/ The ores are thought to be quite similar to Mazul ores. 18/ This would limit their use to blast-furnace charging and still leave the region deficient in metallurgical grades.

Information regarding the Usinsk deposit is highly speculative at the present time. Hence, a fair evaluation of its importance remains a gap in intelligence.

5. Far East (Region XII).

Manganese ore discoveries have been reported in the Soviet Far East, but no information regarding the reserves has been released Known deposits are believed of minor importance.

The first area where manganese ore has been reported is near Volochayevka, on the left bank of the Amur River, within the Jewish Autonomous Oblast. 19/ These deposits are also known as the Vandan Mountain range deposits. The other area is in the Avvakumovka River Basin in Primorskiy Kray. 20/

Some production is believed to be taking place in the Jewish Autonomous Oblast, since mined ore is sent from that area to Komsomol'sk, the iron and steel base for the Soviet Far East. 21/ Production, however, is probably small; Komsomol'sk does not have large requirements for manganese. Steel production is approximately 150,000 tons, and the plant does not have a blast furnace.

D. Production.

Postwar production of manganese ores in the USSR encountered numerous difficulties resulting from wasteful mining practices and destruction during the war. Replacement of wornout equipment, rehabilitation of caved and flooded mines, reconstruction and erection of concentrating plants, and the expansion of operations required immediate attention to meet higher quotas called for in Soviet economic planning.

An important development in the production of manganese since the war has been the increased emphasis upon conservation. Low-grade ores are not now by passed in favor of richer ores, attempts are being made to reclaim old tailings and waste heaps, and greater emphasis is being directed toward improved concentration practices.

A substantial recovery was recorded by 1950, when total production for the year, estimated at 3.5 million tons, surpassed the 1938 high of 3.2 million tons. 22/ Planned 1950 production at Chiatura and Nikopol' was 2.0 million tons and 1.1 million tons, respectively. 23/ Planned production for the Urals, Siberia, and Kazakhstan, at the same time, was unknown. In the terms of 35 percent manganese ore, both Nikopol' and Chiatura failed to meet their targets by several hundred thousand tons, but failure to meet quotas did not detract from the fact that the USSR was now producing above prewar levels and that new, planned increases were not entirely unrealistic. Subsequent information indicates that Chiatura and Nikopol' are meeting their annual production goals of mined ore. Total estimated production of ore and metallic manganese for the USSR, based on published percentages and requirements, is shown in Table 2.*

Because of large reserves and good quality ore, production of manganese continues to be centered on Nikopol' and Chiatura. Their combined production approximates 80 to 85 percent of total production. High levels of production in Chiatura and Nikopol' may be an indication that the Russians are again attempting to re-establish the area-distribution pattern for manganese that was formerly followed. Nikopol' and the eastern deposits supplied domestic requirements, and Chiatura produced large tonnages for export.

* Table 2 follows on p. 14.

Table 2

Estimated Production of Manganese Ore (35 Percent Mn) in the USSR a/
1950-55

Thousand Metric Tons

Year	South	Caucasus	Urals	Central Asia	Siberia	Total Ore	Total Mn Content
1950	986	1,950	379	146	58	3,519	1,232
1951	1,200	2,350	420	162	65	4,197	1,469
1952	1,285	2,560	446	185	75	4,551	1,593
1953	1,371	2,770	488	205	83	4,917	1,721
1954	1,457	2,980	531	230	92	5,290	1,851
1955	1,543	3,190	567	250	101	5,651	1,978

a. Production figures for 1940 and Plan figures for 1950 were published for both Chiatura (Caucasus) and Nikopol' (South). Using the figures as base years along with published percentage figures for the intermittent years, approximate estimates of production of manganese ore for these two deposits could be derived. Urals production is based on requirements of low-grade manganese ores for pig iron production plus 85,000 tons of concentrates. Siberian production is based on pig iron requirements. Central Asia (Dzhezqy deposit) production has been projected from a 1948 figure.

The principal method of working both the Chiatura and Nikopol' deposits is a form of long-wall retreating. Galleries are driven into the ore beds, and the ore is extracted on either side up to the pillars which are left to protect the entry. In recent years, small open-pit operations have also been attempted. 24/

High silica content usually requires that most of the ores from these two deposits undergo a washing process if their commercial value is to be increased. Handsorting, flotation, and electromagnetic separation are used to a lesser degree. Approximately 75 percent of the manganese in the ore is recovered in the concentrate. Present concentration facilities would be a limiting factor in any large increases of concentrated ore planned for these major deposits during the Sixth Five Year Plan. The work of the concentrating plants could be decreased if hydromechanical methods of mining were applied on a larger scale. 25/

Breaking the ore down by the use of water pressure would eliminate part of the clay clinging to the ore. The plants in Nikopol' were all reconstructed during the postwar period and are equipped with new machinery. The majority of the plants at Chiatura are outdated and worn and will eventually have to be replaced. 26/

The total number of manganese ore concentrating plants presently operating in the USSR is 16: at the Chiatura deposits, 10; at Nikopol', 5; and at Polunochnoye, 1. With the exception of two large central concentrating plants, annual capacity for each individual plant has been estimated at 200,000 tons. The central concentrators, one at Nikopol' and one at Chiatura, have been designed for 350,000 to 450,000 tons, annual capacity. 27/ Total concentrating capacity is estimated at 3 million to 3.5 million tons. Grades of concentrates range from 30 to 50 percent manganese.

One of the biggest problems encountered by the manganese ore industry during the postwar period was the lack of mechanical loading facilities. This was especially true at Chiatura, where ore movements from the mining sectors, particularly in the stopes, could not keep pace with the concentrating plants. As late as 1952, more than one-half of the ore was loaded and unloaded by hand. 28/ Moreover, by the end of 1955 the installation of loading machines and scrapers in the mines of the largest Mine Administration within the Chiatura Trust will be only 80 percent complete. Efforts are also being made to mechanize more of the loading operations of the other Mine Administrations in the Chiatura Trust and in the Nikopol' Trust, but as yet, manual methods are heavily relied upon.

Upon completion of the ore preparation process, Chiatura ore is shipped to consumers in the iron and steel and chemical industries, to Poti and Batumi on the Black Sea for export, and, possibly, to a national stockpile. The Zestafoni Ferroalloy Plant, one of the most important producers of ferromanganese in the USSR, is located 35 kilometers south of Chiatura. Formerly, manganese from the Nikopol' deposits was used almost exclusively by the local industry in the Dnieper Bend and Donets Basin. Since World War II, it has also been shipped to Eastern European countries. The better grade concentrates are shipped to Zaporozh'ye for smelting into ferromanganese.

The Urals and Siberian regions produce sufficient low-grade manganese ores for the smelting of pig iron and foundry iron in these areas. Metallurgical-grade ores suitable for smelting ferromanganese

are in short supply. This latter statement is contrary to Soviet reports that wartime development of the manganese ore industry in the Urals, Siberia, and Kazakhstan made the eastern iron and steel plants independent of manganese ore from the southern deposits.

The supply and demand of metallurgical-grade ore in the eastern area is summarized in Table 3.

Table 3

Estimated Production and Requirements of Metallurgical-Grade Ores in the Eastern Areas of the USSR
1950-55

Metric Tons

Year	Urals	Central Asia	Siberia	Total Produced a/	Total Required b/	Deficit
1950	85,000	75,000	0	160,000	277,000	117,000
1951	85,000	85,000	0	170,000	321,000	151,000
1952	85,000	95,000	0	180,000	340,000	160,000
1953	85,000	105,000	0	190,000	376,000	187,000
1954	85,000	115,000	0	200,000	406,000	207,000
1955	85,000	125,000	0	210,000	435,000	225,000

a. Metallurgical-grade only. The combined production of low-grade and metallurgical-grade ore is given in Table 2, p. 14, above.
b. The sum of the requirements for the Urals and Siberia as shown in Table 7, p. 26, below.

Sapalsk, near Nizhniy Tagil, the only deposit in the Urals producing a good grade of metallurgical ore, became depleted during the war. 29/ One small concentrating plant at Polunochnoye is the only one in this area capable of upgrading manganese for use in steel making. 30/ Only half of the concentrates from its 170,000-ton capacity can be used for making ferromanganese. The other half is characterized by a low-manganese and high-phosphorous content and by a poor manganese-to-iron ratio. 31/

Some metallurgical-grade ore is shipped from Kazakhstan in Central Asia. 32/ Kazakhstan ores average 32-percent manganese. Part of the production is screened for size, the larger lumps being specified for ferromanganese production.

The deficit in the eastern areas has to be overcome either by shipping metallurgical-grade ore all the way from Nikopol' or Chiatura, or by shipping ferromanganese from the southern ferroalloy plants. It is believed that because of the long haul and high shipping costs most of the deficit manganese is shipped in the form of ferromanganese rather than ore. This condition has always existed in the eastern area and will continue until new and larger local reserves of metallurgical-grade ore are found.

Deposits which are presently being exploited in the Urals and Siberia do not possess the reserves or quality of ore which would warrant construction of more concentrating plants in these areas. Moreover, for some time yet the ore from these mines will all be needed to satisfy the requirements for ore used for blast furnace charging.

The establishment of a concentrating plant in Kazakhstan region may become a possibility, since some of the newly discovered deposits show promise of large manganese reserves. The establishment of such a plant would contribute largely to solving the problem of a regional high-quality ore supply for the Urals.

E. Trade.

Before the development of other major sources of manganese throughout the world, the abundance of manganese ore reserves in the USSR permitted the USSR to use such ore as a valuable instrument of trade. Prior to the Soviet industrialization programs, the ore was mined principally for that purpose. With the initiation of the Five Year Plans, exports of manganese ore continued but gradually decreased as a percentage of total production. The sale of surplus ore to the principal manganese-consuming countries, the US, Germany, France, and others, provided the USSR with means to purchase capital equipment and other strategic materials necessary for industrial expansion. Exports for each of the years 1929 and 1937 surpassed 1 million tons and for the intermediate years averaged 650,000 tons. 33/

Because of the high quality of the ore and the short rail haul to the Black Sea ports of Poti and Batumi, most of the exported ore comes from the Chiatura deposits. The Nikopol' deposits are also within

easy access of Black Sea port facilities, but production here is more accessible to domestic consumers.

During World War II the loss of Nikopol' to the Germans and the blockade of the Black Sea caused all exportation to cease. In 1945, when shipping again became possible, the USSR resumed manganese ore shipments. Continued increases in ore shipments indicated that, at that time, the USSR was attempting to regain its prewar position in the world manganese market.

1. Trade with Non-Soviet Bloc Countries.

Soviet exports of metallurgical ore to the US during 1948 totaled 387,000 metric tons, 25 percent of the US import requirement. 34/ During 1949, increased tensions between the Soviet-dominated Bloc and the Free World suddenly caused the USSR to stop such shipments. Shipments of Soviet manganese to the US for the years 1949 and 1950 amounted to only 74,000 and 59,000 tons, respectively. 35/ During succeeding years there have been practically no imports. Trade restrictions during this time limited the Soviet manganese market to the Soviet Bloc and Scandinavia, except for a few small shipments, principally to Italy, Belgium, and the Netherlands.

Because of these trade restrictions, the Western nations, especially the US, were forced to finance the development and expansion of new and larger sources of manganese ore throughout the rest of the world. A tight manganese market soon developed, as nations scrambled to assure themselves a sufficient supply of this critical material. Bidding between Western countries for available metallurgical-grade production of non-Bloc countries soon caused an upswing in prices.

What appeared to be a strategic move on the part of the USSR in discontinuance of manganese ore shipments to the West had only a temporary effect and apparently worked to the disadvantage of the Soviet economy. Where once the major iron and steel producing nations of the world depended partially upon Russian manganese, the 1949 shift of Soviet trade policy resulted in the expansion and development of other manganese sources which are now producing sufficient quantities to eliminate altogether any dependence on Soviet ore.

Near the end of 1952, when manganese ore was no longer particularly scarce, offers of Chiatura manganese reappeared in trade channels through European ore dealers. The quantities in a number of

cases were large, and such offers must have been made with full knowledge of the USSR. 36/ During 1953, offers of ore continued to come through foreign intermediaries but also were made direct by Amtorg representatives to buyers in the US. An increasing number of trade negotiations and agreements between the USSR and Western nations came to include Soviet manganese ore. Table 4* shows estimated exports of Soviet manganese ore to non-Bloc countries for the period 1948 to 1954.

The Soviet-Belgian trade agreement signed in January 1954 runs for 3 years. During 1954, Belgium will import 90,000 tons of manganese ore and 10,000 tons of ferromanganese. 37/ Within the scope of the current 3-year Soviet-French trade agreement signed in January 1954, France is scheduled to import 30,000 tons of manganese ore during 1954. 38/ The purchase of Soviet manganese by England in December of 1953 was the first since World War II. The amount of the contract is unknown, but from December 1953 to May 1954, English imports of Soviet manganese ore have approximated 98,000 tons. 39/ West Germany has been reported as an importer of Soviet manganese during 1953. Soviet-West German trade negotiations during the summer and fall of 1953 included an exchange of German-built fishing trawlers for Soviet manganese. 40/

Several offers of Soviet manganese for surplus butter and cottonseed oil have been made to the US within the last twelve months. They are not the first recent offers to the US, but they are the first of significant magnitude. In January 1954 the USSR offered 600,000 tons of manganese ore at $48 per ton in exchange for 20,000 tons of butter at world butter prices. 41/ Another offer was made in February 1954; this time the USSR was willing to trade at US support prices rather than world prices. 42/ No trade has developed from these offers to the US.

Renewed Soviet interest in the world manganese market has not been limited to Western nations. Efforts to capture the manganese exporting business to Japan have also been reported. The signing of a 2-year provisional barter-trade agreement during June 1954 includes manganese ore as one of the items Japan will receive from the USSR. 43/ The reappearance of Soviet manganese ore in world markets is a very disturbing factor to present suppliers. Competition from Soviet manganese has already been reported by the Philippines and by India. 44/

* Table 4 follows on p. 20.

Table 4

Estimated Soviet Exports of Manganese Ore to Non-Soviet Bloc Countries
1948-54

Metric Tons

	1948	1949	1950	1951	1952	1953	1954
Belgium	15,574 45/	0 46/	8,600 47/	3,500 48/	9,820 49/	56,950 50/	90,000 51/ a/
Netherlands	517 52/	7,800 53/	N.A.	2,000 54/	1,516 55/	19,500 56/	N.A. 57/ a/
Norway	4,904 58/	4,000 59/	27,900 60/	20,000 61/	17,563 62/	30,000 63/	30,000 64/ a/
Sweden	12,000 65/	15,300 66/	5,000 67/	20,400 68/	20,000 69/	15,000 70/	15,000 71/ a/
Italy	N.A.	15,813 72/	N.A.	4,000 73/	25,930 74/	N.A.	25,000 75/ a/ b/
France	N.A.	N.A.	N.A.	N.A.	19,000 76/	11,850 77/	30,000 78/
UK	0	0	0	0	0	27,600 79/	65,400 80/
West Germany	N.A.	N.A.	N.A.	N.A.	N.A.	72,626 81/	N.A.
US	387,000 82/	74,000 83/	59,000 84/	1,163 85/	0	0	
Total	419,995	116,913	100,500	51,063	93,829	233,526	255,400

a. Trade agreements in effect.
b. Amount of manganese ore to be imported during a 12-month period commencing October 1953. No shipments were reported from October through December 1953.

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Dollar payments are ordinarily required when the ore is sold through foreign intermediaries. Direct offers have included both currency and exchange-of-goods terms. The exchange-of-goods basis would present the USSR with the opportunity of including strategic items on their list of request items. Offers to US importers have not been favorably received, as the asking prices have not provided sufficient inducement to warrant a change of sources of supply. The US import duty levied against manganese shipments from the Soviet Bloc countries also discourages imports. Duty on manganese imported from the Bloc is 1 cent per pound of contained manganese,* whereas ore from other nations pays only one-fourth of a cent per pound of contained manganese. Ores from Cuba and the Philippines are duty free.

Reasons for the renewed attempts of the USSR to export manganese ore on a broader scale could be any one or more of the following:

a. The USSR is attempting to recapture part of the world manganese market after failing to short supply the non-Soviet Bloc nations.

b. The USSR needs currencies for the dollar and sterling areas in its attempt to purchase materials which are lacking in the Soviet Bloc.

c. Manganese ore is being used as an instrument of barter in efforts to obtain critical raw materials and consumer goods.

d. The present level of production may be in excess of consumption and stockpile requirements.

Possible results of such exports are worth noting:

a. An unstable manganese market will certainly develop, if Soviet manganese is dumped on world markets at slashed prices.

* On 5 January 1952, the President of the US, by power accorded him through the Trade Agreement Extension Act of 1950, restored the full tariff rate of 1 cent per pound of contained manganese (Hawley-Smoot Tariff Act of 1930) on Soviet manganese ore imported into the US. Similar action was taken against the other Bloc countries at later dates.

b. Large purchases of Soviet manganese by the West may cause difficulties between Western nations and the present suppliers, all of whom are outside the Soviet orbit.

c. Soviet willingness to trade manganese ore for exportable surpluses of Western Europe may bring about closer economic ties between these two areas.

2. Intra-Soviet Bloc Trade.

The three important steel-producing countries of Eastern Europe -- East Germany, Poland, and Czechoslovakia -- are totally or partially dependent on Soviet manganese. The balance of the Soviet Bloc countries either are self-sufficient or their requirements are not large. Czechoslovakia produces approximately two-thirds of its manganese consumption, whereas Poland and East Germany must import their total supply. Exports to these countries originate mostly in the USSR, the balance consisting of shipments from Turkey, Iran, India, Rumania, Bulgaria, and Hungary. Ore shipments to Czechoslovakia and East Germany usually consist of direct rail shipments from Nikopol'. Ore consigned to Poland is generally Chiatura ore transported by ship to Polish Baltic ports. Approximately all manganese dioxide shipped to Eastern European countries comes from Chiatura. Estimated Soviet exports of manganese ore to Bloc countries are shown in Table 5.*

Minor shipments of ferromanganese are treated in the respective country sections of this report.

F. Consumption.

The iron and steel industry accounts for 90 to 95 percent of the domestic consumption of manganese in the USSR. Use of manganese for alloying purposes in nonferrous metallurgy is of great importance, but the quantity used has little bearing on the over-all amount of manganese consumed. Requirements for chemicals and dry-cell batteries are presumed to be relatively less important than they are in the US.

* Table 5 follows on p. 23.

Table 5

Estimated Soviet Exports of Manganese Ore
to Soviet Bloc Countries a/
1949-55

Thousand Metric Tons

Year	Czechoslovakia b/	Poland c/	East Germany d/	Estimated Total
1949	81.0	144.0	21.2	246.2
1950	87.0	92.0	25.0	204.0
1951	89.0	74.0	42.0	205.0
1952	97.0	86.7 e/	120.0	303.7
1953	107.0	160.0	180.0	447.0
1954	N.A.	106.0	220.0	N.A.
1955	N.A.	N.A.	250.0	N.A.

a. A detailed explanation of these exports is found in the respective country sections of this report.
b. Planned imports.
c. Actual with the exception of 1953.
d. Planned with the exception of 1949 and 1950.
e. Estimate covers shipments from January through October.

1. Ferrous Metallurgy.

a. Pig Iron.

Consumption of manganese in Soviet ferrous metallurgy is considerably higher than it is in the US. The principal difference is reflected by the extensive use of low-grade manganese ores in smelting blast-furnace pig iron. Usually ores containing 20 to 30 percent manganese cannot be used economically for making ferromanganese but are acceptable for making pig iron.

The composition of the iron ore and coking coal in the USSR, especially that used in the plants west of the Ural Mountains, requires unusually large additions of manganese to the blast-furnace charge if satisfactory pig iron is to be obtained. This is the result primarily of the presence of large amounts of

sulfur in Donets coke and of the low manganese content of Krivoy Rog iron ores. Furthermore, Chiatura and Nikopol' manganese ores are powdery, resulting in an appreciable loss of manganese in the furnace blast. Finally, the presence of large amounts of silica in the charged ores requires additional limestone to flux the silica, which -- in turn -- results in greater quantities of slag with increased losses of manganese.

Consumption of metallic manganese has been calculated from what is considered a normal blast-furnace charge in Soviet furnaces. (See Appendix B, Table 36.) Total metallic manganese required to make 1 metric ton of pig iron enters the furnace in the form of raw materials. Table 6 shows amounts of metallic manganese consumed per ton of pig iron in blast-furnace charges in the USSR.

Table 6

Amounts of Metallic Manganese Consumed per Metric Ton of Pig Iron in Soviet Blast-Furnace Charges 86/

Form in Which Introduced	Unit	Ukraine and Central European USSR	Urals	Siberia
Iron Ore	Kilograms	2.6	12.2	3.6
Slag	Kilograms	11.4	5.7	8.1
Scrap	Kilograms	0.6	None	0.6
Manganese Ore	Kilograms	33.0	16.0	13.0
Total	Kilograms	47.6	33.9	25.3
Total Weight of Charge per Metric Ton of Pig Iron	Kilograms	2,621	2,632	2,289
Mn Metal in Charge	Percent	1.82	1.33	1.11
Mn Content of Pig Iron	Percent	2.51	1.97	2.03
Mn Recovery in Pig Iron	Percent	53.00	56.00	80.00

b. Steel.

Consumption of manganese in the form of manganese ferroalloys ranges between 5 and 7 kilograms per ton of ingot steel. 87/ This approximates the US practice of 6.5 kilograms per ton of ingot steel 88/ and confirms the assumption that the excess of USSR usage of manganese over US usage takes place principally in the reduction of iron ores rather than in an abnormal production of manganese steels.

A breakdown of Soviet consumption of manganese ore for the various manganese ferroalloys such as ferromanganese, silicomanganese, and spiegeleisen, cannot be determined, but ferromanganese will comprise the greatest percentage. Consumption of ferromanganese in the US from 1947 to 1950 accounted for 80 percent of the manganese content of the total manganese ferroalloys consumed. 89/

Irrespective of the form in which manganese is added to the steel, any information available as to the average input of metallic manganese per ton of ingot steel gives a basis for determining the amount of manganese ferroalloys consumed. Most of the quality ferromanganese consumed in the USSR is produced from Nikopol' and Chiatura ores and concentrates running 48 percent manganese. To produce 1 ton of ferromanganese requires approximately 2 tons of 48 percent ore. When using Urals manganese ore, approximately 3 tons of 30- to 35-percent manganese ore is necessary for 1 ton of ferromanganese.

Estimated total consumption of manganese by the iron and steel industry in the USSR is shown in Table 7.* The principal plants producing manganese ferroalloys in the USSR are listed in Table 8.** 90/

The total amount of metallic manganese introduced into the whole iron- and steel-making process per ton of ingots in the US is 21 kilograms. 91/ This is in the form of iron and manganese ores, slag, scrap, and manganese ferroalloys. In the USSR comparable figures for the total of metallic manganese required per ton of final product are: for the iron and steel plants in the South, 53.6

* Table 7 follows on p. 26.
** Table 8 follows on p. 27.

Table 7

Estimated Total Consumption of Manganese by the Iron and Steel Industry in the USSR a/
1950-55

Thousand Metric Tons

Area	1950		1951		1952		1953		1954		1955	
	Ore	Metal	Ore	Metal	Ore	Metal	Ore	Metal	Ore	Metal	Ore	Metal
South and Central b/												
Pig Iron	1,141.3	285.3	1,433.0	358.2	1,537.3	384.3	1,714.9	428.7	1,898.7	474.7	2,082.4	520.6
Foundry Iron	86.5	21.6	98.6	24.6	116.5	29.1	130.0	32.5	143.8	36.0	157.8	39.4
Manganese Ferroalloys	229.8	114.9	264.6	132.3	301.8	150.9	334.4	167.2	360.8	180.4	386.3	193.2
Total	1,457.6	421.8	1,796.2	515.1	1,955.6	564.3	2,179.3	628.4	2,403.3	691.1	2,626.5	753.2
Urals c/												
Pig Iron	355.7	88.9	405.5	101.4	436.9	109.2	487.4	121.9	539.6	134.9	591.9	148.0
Foundry Iron	55.6	13.9	63.4	15.8	68.3	17.1	76.2	19.0	84.3	22.0	92.5	23.1
Manganese Ferroalloys	225.1	75.1	262.1	87.4	279.9	93.3	310.1	103.4	334.6	111.5	358.2	119.4
Total	636.4	177.9	731.0	204.6	785.1	219.6	873.7	244.3	958.5	268.4	1,042.6	290.5
Siberia d/												
Pig Iron	111.6	20.1	127.1	22.9	145.0	26.1	161.8	29.1	179.1	32.2	196.4	35.4
Manganese Ferroalloys	52.0	26.0	59.9	29.9	60.4	22.6	66.9	33.4	72.2	36.1	77.3	38.6
Total	163.6	46.1	187.0	52.8	205.4	48.7	228.7	62.5	251.3	68.3	273.7	74.0
Total USSR	2,257.6	645.8	2,714.2	772.5	2,946.1	832.6	3,281.7	935.2	3,613.1	1,027.8	3,942.8	1,117.7

a. For methodology, see Appendix B.
b. Mn content of ore for pig and foundry averages 25 percent; Mn content of ore for manganese ferroalloys averages 48 percent.
c. Mn content of ore for pig and foundry averages 25 percent; Mn content of ore for manganese ferroalloys averages 30 to 35 percent.
d. Mn content of ore for pig iron averages 18 percent; Mn content of ore for manganese ferroalloys averages 48 percent.

Table 8

Principal Plants Producing Manganese Ferroalloys in the USSR a/

Plants b/	Region	Coordinates	Probable Source of Ore
Zaporozh'ye (E)	Ukrainian SSR (Region III)	47°12' N - 35°11' E	Nikopol'
Konstantinovka (B)	Ukrainian SSR (Region III)	48°31' N - 37°42' E	Nikopol' and Chiatura
Makeyevka (B)	Ukrainian SSR (Region III)	48°03' N - 37°57' E	Nikopol' and Chiatura
Dnepropetrovsk (B)	Ukrainian SSR (Region III)	48°28' N - 34°57' E	Nikopol' and Chiatura
Zestafoni (E)	Georgian SSR (Region V)	42°07' N - 43°02' E	Chiatura
Tula (B)	Tula Oblast (Region VII)	54°07' N - 37°33' E	Nikopol' and Chiatura
Magnitogorsk (B)	Chelyabinsk Oblast (Region VIII)	53°25' N - 59°03' E	Polunochnoye and Dzhezdy
Stalinsk (E)	Kemerovo (Region IX)	53°46' N - 87°12' E	Chiatura
Aktyubinsk (E)	Kazakh SSR (Region Xa)	50°20' N - 57°09' E	Unknown

a. Most blast furnaces used in the reduction of iron ores can be utilized to smelt ferromanganese.
b. (E) = electric furnace, (B) = blast furnace.

kilograms; for the Urals, 39.9 kilograms; and for the Kuznetsk Basin, 31.3 kilograms.* Manganese consumption per ton of steel in the USSR thus is more than double the US rate.

* These figures were derived by adding to the figures for iron given in Table 6 a median figure of 6 kilograms for steel.

2. Chemical Uses.

Consumption of manganese dioxide ores by the chemical industry of the USSR does not involve large tonnages, but the quality of the ore is of major importance. The content of manganese dioxide must not be lower than 80 percent, the equivalent of 50 percent metallic manganese in oxide form. 92/ Of all chemical uses the production of dry cells has assumed the greatest importance in the past 25 years, especially in connection with the development of radio technology. Manganese dioxide is used also for the discoloration of green glass; in photography; in chemical preparations used in medicines; and in the production of drying oil, grease, wax, chrome leather, paints, bromine, and iodine.

Because of lack of data, it is not possible to estimate manganese dioxide consumption in the USSR. In the US, consumption of manganese dioxide in the production of dry cells is about 40,000 tons annually, and for other chemical uses about 20,000 tons annually. 93/ Soviet consumption for similar purposes is believed to be considerably less. In any event, the quantities of manganese consumed as manganese dioxide in the USSR are small in relation to the total consumption of manganese-bearing ore.

G. Summary Analysis of Production and Consumption.

A summary of estimated production, consumption, exports, and apparent surplus of manganese ore for the USSR during the period 1950 through 1955 is shown in Table 9.*

Table 10 shows that in terms of 35 percent manganese ore, the USSR has been producing between 1 and 2 million tons annually in excess of that needed for domestic requirements and foreign trade. If the estimates in Table 10 are correct, this difference, minus any correction for exports of ferromanganese or for unreported exports of ore, would have to represent inventory stocks of ore or high-grade concentrates.

There have been no reports to substantiate the existence of manganese stockpiles within the USSR. In view of the absolute essentiality of manganese to the iron and steel industry, and of the concentration of 80 to 85 percent of the supply in two producing

* Table 9 follows on p. 29.

Table 9

Summary Analysis of Supply and Consumption of Manganese Ore in the USSR a/

Thousand Metric Tons

	Estimated Production b/		Apparent Consumption c/ d/		Estimated Exports e/		Apparent Surplus	
Year	Ore	Metallic Content	Ore	Metallic Content	Ore	Metallic Content	Ore	Metallic Content
1950	3,519	1,232	1,886	660	305	107	1,328	465
1951	4,197	1,469	2,249	787	256	90	1,692	592
1952	4,551	1,593	2,420	847	397	139	1,734	607
1953	4,917	1,721	2,711	949	681	238	1,525	534
1954	5,290	1,851	2,977	1,042	475	166	1,833	643
1955	5,651	1,978	3,237	1,132	250	88	2,164	758

a. Figures for ore are based on 35 percent manganese content and therefore cannot be directly related to the consumption tonnage figures given in Table 7, which are based on the Mn content of ore required for the various products of the iron and steel industry.
b. See Table 2, p. 14, above.
c. All domestic consumption has been converted to 35 percent Mn for arithmetical purposes.
d. Includes 40,000 tons yearly to cover estimated consumption for chemical uses.
e. Total exports of ore to Soviet Bloc and non-Bloc countries. Exports for 1954 and 1955 are planned exports or trade agreements.

centers, however, the establishment of a reserve stockpile as suggested in the above analysis is entirely plausible.

H. Expansibility.

The expansion of the Soviet manganese industry will be limited only by demand; ore reserves are not a limiting factor. Soviet and Satellite requirements for manganese will continue to mount rapidly if the ambitious planned goals for iron and steel production are attained. In addition, manganese is one of the few commodities readily available in quantity which the USSR can use for payment of imports.

Chiatura and Nikopol', in spite of their vulnerability, will serve as the main bases for expanding production. In addition to ample reserves to support expansion, proximity to exporting ports and to the major Soviet and Satellite centers of steel production assures the continued expansion of production from these two deposits. Available information indicates, however, that the USSR will continue its efforts to locate new reserves and to expand "proven" reserves in the Urals and in Siberia.

III. Communist China.

A. Resources.

The most important manganese ore reserves of Communist China are located primarily in South China, where the deposits are substantial and of high quality. According to prewar estimates, proven reserves of manganese ore in China are indicated as 29 million tons, of which 20 million tons are considered of metallurgical grade. In addition, there are less important deposits in China and Manchuria, surveyed chiefly by the Japanese, which have a combined reserve of approximately 3 million tons. 94/ The amount of ore mined in China since 1940 has not been sufficient to make necessary any alteration of the estimates made in that year. Table 10* gives estimated manganese ore reserves in Communist China. The 1940 estimates have been altered only to the extent necessary to provide for changes in provincial boundaries.

* Table 10 follows on p. 31.

Table 10

Estimated Reserves of Manganese Ore
in Communist China a/

Metric Tons

Province	Manganese Ore	Manganese Percent of Content
Fukien	931,000	34 to 43
Hunan	1,550,120	20 to 58
Kansu	800,000	41 to 47
Kiangsi	3,758,600	38 to 52
Kwangtung	5,661,000	20 to 58
Kwangsi	16,638,000	47 to 50
Others b/	3,000,000	
Total	32,338,720	

a. For a more detailed study of China's manganese ore reserves, see NIS-39.
b. Does not include low-grade (3 to 20 percent) manganiferous ores of Manchuria.

The richest ore, confined to beds near the surface, consists of nearly pure psilomelane nodules and has a manganese content over 40 percent. The low-grade ore, which ranges from 20 percent to less than 40 percent manganese, is chiefly sandstone impregnated with psilomelane and pyrolusite. Most of the richer grade ores suitable for steel production are found in the provinces of Kwangtung, Kwangsi, Kiangsi, and Hunan. These 4 provinces contain 22 million tons of the better grade ores.

The best deposits in China are those found in Wu-hsuan (23°35' N - 109°45' E) and Kuei-p'ing (23°34' N - 110°13' E) Districts, Kwangsi Province. The ore in these deposits, mostly psilomelane containing 50 to 53 percent manganese, is suitable for direct shipment without first undergoing concentration. 95/ Although reserves are fairly substantial and of good quality, climatic conditions have limited production to the months of October through March.

Combined reserves of three Chin District deposits (22°05' N - 108°29' E) -- formerly in Kwangtung Province, now in Kwangsi Province -- total 13 million tons, approximately 40 percent of the "proven" reserves in China. This ore, however, is of uneven grade and must be sorted, if a top-quality product is to be obtained. Most of the ore contains 33 to 45 percent manganese. 96/

Ores of good metallurgical grade are found also in the Chung-pu-chia deposit, Kiangsi Province. Manganese content ranges from 38 to 55 percent, with an iron content of 20 percent and with silica only 2 percent.

Manganese discovered in Kweichow Province has not been extensively worked. It has been reported that 500,000 tons of high-grade ore exist in the north-central part of the province. 97/ Lesser deposits of manganese in the same province have been reported at Tung-shang, Weng-yen, Tang-tzu-ssu, and Mao-chia-shan. 98/

The scope of the Japanese surveys, conducted during Japanese occupation of Manchuria and of the coastal sections of China, extended far beyond the proved areas of South China and covered the eastern portion of the country in general, but as yet the full results of the surveys are not available. A small deposit containing 23,000 tons of 35 percent ore was opened by the Japanese in the Ping-Ku District (40°60' N - 117°09' E), Hopeh Province. 99/ In Kiangsu Province three new deposits were opened by the Japanese -- Wang-shan and Lung-shan-kou, both near Nanking, and Hsi-hsia-shan, in the Chen-chiang District (32°12' N - 119°28' E). 100/

Substantial deposits of low-grade ores were discovered and exploited in Manchuria by the Japanese. The Wa-fang-tzu deposits in the Kharchin District (41°40' N - 118°50' E), Jehol Province, were discovered in 1938. Reserves are listed as 3 million to 10 million tons. The ore bears 3 to 20 percent manganese and is found in conjunction with hematite iron ore. 101/ Nearby is another deposit called the Kao-ch'iao deposit. Latest reports indicate it to be nearly exhausted.

The Tsai-chia-t'un deposit (40°54' N - 120°36' E) in the Chin-hsi District, Liaosi Province, once contained an estimated 280,000 tons of 35-percent ore, but latest reports indicate that the deposit is nearing depletion. 102/ The same applies to the nearby Lan-chia-kou deposit (40°54' N - 120°36' E). Another deposit

in Liaosi Province is found at Hsing-ch'eng (40°38' N - 120°42' E) near Chin-hsi. In Liaotung Province, a manganese mine is located near Feng-ch'eng. The Chi-tau-kou iron ore deposits (41°30' N - 126°15' E), in the Tung-pein-tao region of the T'ung-hua District, Liaotung Province, contain 3 to 10 percent manganese in the ore. 103/

Manganese reserves in Manchuria, are generally substantial but of low quality. The deposits are, however, significant in view of the fact that the Manchurian iron and steel industry provides a ready market.

The location of the better grade ore bodies of Communist China in the southern provinces of the country places them at a considerable distance from the iron and steel plants of the North and Northeast. This situation is emphasized by the lack of adequate transportation facilities.

The proposed iron and steel center in Tayeh, Hupeh Province, would involve much less of a "long-haul" problem, as far as manganese supply is concerned. A recent discovery of manganese ore near the Tayeh area is reported to be undergoing extensive examination. 104/ Ore in this area was once reported as only manganiferous, which would limit its use to the smelting of pig iron.

A number of geological exploration parties are conducting surveys throughout Communist China. A great deal of their work is spent on established deposits, where preliminary examinations have not been sufficient to draft future exploitation plans. 105/ Despite the fact that manganese ores are found in a large number of localities in China, only about 10 fields have been investigated properly geologically. 106/ Some aid has been received from the USSR, but on the whole Communist China lacks the trained personnel required for this type of work.

B. Production.

Production of manganese ore has never been of major importance in China. Since China's domestic requirements are small, past production has varied mainly with political stability and export demands. The peak year was 1937, when 80,000 tons were produced, of which 51,500 tons were exported.

During World War II, Japanese exploitation of China's manganese resources were more or less limited to the low-grade deposits in Manchuria. In 1941, 4 deposits -- Wa-fang-tzu, Tsai-chia-tun, Lan-chia-kou, and Kao-ch'iao -- worked by the Japanese in Jehol and Liaoning Province producted 18,197 tons of ore. 107/ Total production from the Manchurian deposits in 1943 was 45,383 tons. 108/

Except for a few scattered operations in the southern provinces of Kwangsi and Kwangtung, postwar manganese ore mining remained virtually static. Continued internal disorder and a paralyzed iron and steel industry* prevented there being any market for the product.

Following the overthrow of the Chinese National Government in 1949, the Communist government initiated a new program for the rehabilitation and expansion of industrial enterprises and for the development and exploitation of China's natural resources. Many of the important manganese deposits were immediately nationalized; others remained under private ownership subject to State supervision. 109/

Manganese ore mining in Communist China does not involve large-scale operations or extensive use of machinery. Annual production varies from a few hundred tons to several thousand tons for individual deposits. There is little reason to believe that the mining and concentration of manganese ore in China has progressed much beyond primitive methods utilizing cheap labor. Most of the ore is mined by open-pit operations with little or no power-driven machinery. 110/

As of 1953, manganese ore production continues to be centered on the rich deposits in the area south of the Yangtze River. Although the Chinese potential is substantial, for so long as

* The Manchurian iron and steel mills suffered severe war damage as a result of looting by the Russians, followed by civil conflict in China.

domestic requirements remain small with no large-scale export trade reported, it can be assumed that production is, and will be, geared to internal needs and minor exports. Table 11 shows actual production of manganese ores from 1935 to 1947 and estimated production from 1948 to 1955.

Table 11

Production of Manganese Ore
in China and Manchuria 111/
1935-55

Metric Tons

Year	China Proper	Manchuria a/	Total b/
1935	31,000	400	31,400
1936	43,000	400	43,400
1937	78,000	400	78,400
1938	1,958	500	2,458
1939	670	500	1,170
1940	2,870	500	3,370
1941	550	18,197 c/	18,747
1942	500	28,742 c/	29,242
1943	10,475	45,383	55,858
1944	9,880	45,000 d/	54,880
1945	16,400	25,000 d/	41,400
1946	N.A.	N.A.	9,600
1947	N.A.	N.A.	20,000
1948	N.A.	N.A.	22,000
1949	N.A.	N.A.	20,000
1950	N.A.	N.A.	34,700 e/
1951	N.A.	N.A.	64,100
1952	N.A.	N.A.	89,400
1953	N.A.	N.A.	105,100
1954	N.A.	N.A.	129,600
1955	N.A.	N.A.	145,200

a. Mostly low-grade ores.
b. Separate production is not available for China proper and Manchuria after 1945.
c. Based on mine production and mine capacity of four mines known to have been operated by the Japanese during World War II.

Table 11

Production of Manganese Ore
in China and Manchuria
1935-55
(Continued)

d. Estimated.
e. Figures for 1950-55 are estimates based on requirements and trade.

During 1950, by order of the Communist Central Government, emphasis was placed on the operation of the Shan-wu-tu (28°03' N - 112°50' E) and Chiu-tang-chung (27°49' N - 112°41' E) deposits, in the Hsiang-t'an District, Hunan Province. This area has always been important for its high-grade ore. 112/ Operations were suspended during the war, but when they were resumed in 1946, marketing limitations kept production down to a few hundred tons a month. The ore was sold principally to Shanghai buyers.

Operation of the mines after 1950 was intended to supply the steel plants in North and Northeast China. The first annual requirement assigned to the Hsiang-t'an District mines was 3,000 tons of ore, and this may have been subsequently increased. 113/ Total production for Hunan Province in 1952 was reported at 40,000 tons of ore. 114/ In addition, the Hunan deposits of Chang-ning and Yu-shui-ch'ung (26°44' N - 113°18' E), the Lei-yang District, 3 kilometers from the city of Anjen, were reported as being exploited in 1953. 115/

During 1950, production emphasis was also placed on the San-li deposit in Wu-hsuan and the Mu-kuei-hsii and Ma-p'i-hsu deposits in Kuei-p'ing, both in Kwangsi Province. The Mu-kuei-hsii/Ma-p'i-hsu, in 1937, was the largest single producing deposit in China, with an annual output of 54,000 tons. K'ung-tung-ling, in the Chin District, is also reported as being in operation. Production for the entire province during the years 1947 and 1948 was 650 tons and 610 tons of ore, respectively. 116/ Production in 1952 for the three deposits -- Mu-kuei-hsii, Ma-p'i-hsu, and San-li -- was at the rate of 1,800 tons annually. Exploitation was hindered by the lack of transportation facilities. 117/

The Chung-fu-chieh and Tien-shan-feng deposits near Lo-p'ing, Kiangsi Province, resumed operations in April 1950 after being idle since 1930. Mined ore was scheduled for shipment to the North and Northeast. Planned production for the year was set at 6,000 tons. 118/ The Kiangsi deposit of Pai-mao (27°31'N-113°48'E) in the P'ing-hsiang District, is also reported in operation, but the extent of its production is unknown. 119/

Production of manganese ore has been reported in the province of Kweichow, but its exact location is unknown. 120/ Concentration of manganese has been reported within the Special District of Tsuni. The location of concentrating facilities in the Tsuni area may well indicate the exploitation of a new, local ore body. Ore containing 40 percent manganese, and manganese fines containing 75 to 80 percent manganese dioxide, have been offered for sale by this plant. 121/

There are a number of other deposits reported as being worked by the Chinese Communists, for instance: the Hsiao-hu-shan deposit (31°20'N-118°23'E) near Wu-hu, Anhwei Province; the Ta-chih-yu deposit, Fang-ch'eng District, now in Kwangsi Province; and the deposits near Lan-t'ien (34°03'N - 109°20'E) and Lin-t'ung (34°24'N - 109°13'E) in Shensi Province. 122/

In the Manchurian area, the Lan-chia-kou deposit in the Chin-hsi District and Hei-shung-ling deposit in Hsing-ch'eng District, both in Liaosi Province, are reported as undergoing exploitation. 123/ There is no activity reported at the Wa-fang-tzu deposit in Jehol, but the proximity of this low-grade deposit to An-shan and other iron and steel centers of Manchuria would seem to warrant exploitation.

C. Trade.

Following World War II, small quantities of ore produced in the South China provinces of Kwangsi and Kwantung were sold to Hong Kong ore dealers for export to Japan. Total Japanese imports of South China manganese ore were reported as 13,482 tons in 1949. 124/

Under the present Communist regime, China has been exporting small quantities of manganese ore. Several ore shipments have been reported to Soviet Bloc countries from Tsingtao by way of Constanza, Rumania, from where it is believed to be transshipped. The rest has gone to Japan, with the exception of a small cargo going to France. No shipments to Japan were reported in 1951 and 1952. A

trade agreement which included an unknown quantity of manganese ore was reportedly signed between China and Japan during October 1953. 125/ Reported exports of manganese ore from China are shown in Table 12.

Table 12

Reported Exports of Manganese Ore from China
1934-54

Metric Tons

Year	Amount	Year	Amount
1934	870 a/	1945	N.A.
1935	827	1946	2
1936	23,794	1947	0
1937	51,446	1948	402
1938	1,247	1949	13,482 127/ b/
1939	1	1950	1,160 128/ b/
1940	0	1951	8,500 129/
1941	4,847 b/	1952	20,065 130/
1942	11,712 b/	1953	7,736 131/
1943	10,880 b/	1954	N.A.
1944	9,880 b/		

a. Figures for 1934 to 1948 were taken from source 126/.
b. Japan only.

Japan is the logical customer for the large surpluses of manganese ore that Communist China could produce if markets were available. Other Eastern steel-producing countries, such as India, have a surplus of manganese. The USSR is the closest source for the European Satellites, although the Chinese Communists will probably continue as a minor supplier either on an exchange-of-goods basis or because of the availability of shipping space.

D. Consumption.

With the exception of exports, practically all of the manganese ore produced in China is consumed by the iron and steel industry (mainly in Manchuria). The principal consuming plants

are located at Anshan, Pen-ch'i, Shih-ching-shan, Tai-yuan, Shanghai, Tsingtao, Tangshan, and Chungking. It is estimated that Manchuria contributes about 60 percent of the total output of pig iron and 70 percent of the steel in Communist China. Standard ferromanganese was once produced in the Anshan plant, but the extent of present production is unknown. In general, the status of domestic facilities for making ferromanganese would indicate that in Communist China a shortage of this material may exist. 132/ Imports of ferromanganese have been reported from the USSR. 133/ Attempts to make low-carbon ferromanganese, all of which formerly had to be imported, were finally termed a success at the Anshan plant during the latter part of 1953. 134/

There is no direct information on the amount of manganese ore consumed by the Chinese iron and steel industry. Consumption, therefore, has been estimated from requirements and is shown in Table 13.

Table 13

Apparent Consumption of Manganese Ore by the Iron and Steel Industry in Communist China a/
1950-55

Metric Tons

Year	Pig Iron		Ingot Steel		Total	
	Ore (35 Percent)	Metallic Content	Ore (35 Percent)	Metallic Content	Ore (35 Percent)	Metallic Content
1950	18,534	6,487	13,174	4,611	31,708	11,098
1951	28,185	9,865	18,911	6,619	47,096	16,484
1952	35,908	12,568	28,474	9,966	64,382	22,534
1953	42,665	14,933	37,400	13,090	80,065	28,023
1954	58,497	20,474	46,111	16,139	104,608	36,613
1955	66,605	23,312	53,548	18,742	120,153	42,054

a. For methodology, see Appendix B.

The use of iron ores with a substantial manganese content results in a considerable reduction of the amount of manganese ores that would ordinarily be added to the blast furnace charge. The proximity

of several manganiferous iron ore deposits to the Manchurian iron and steel plants is important in this respect.

Nonferrous and nonmetallurgical uses of manganese are almost negligible in China.

E. Expansibility.

Although manganese ore reserves in China are not exceptionally large, present geological estimates indicate that high-grade ore is sufficient to provide the manganese requirements of a 5-million-ton-per-year steel industry for several hundred years. The large quantities of low-grade ores, especially those of Manchuria, provide an even greater supply. Large sections of China still unexplored for mineral wealth are also potential sources of manganese reserves.

Formerly all the important deposits in China were mined by hand labor employing open-cut methods. Any production increases needed to meet larger domestic requirements or possibly increased exports could be accomplished relatively easily either by recruiting more manpower or by employing mechanized methods. Consequently demand factors are most likely to determine future output, more particularly the extent to which trade is revived, especially with Japan, and the rate at which Communist China can expand its iron- and steel-producing facilities. It is estimated that China's steel production will reach 4.2 million tons by 1960. The Plans call for an estimated 5.9 million tons.

IV. Hungary.

A. Resources.

Manganese deposits in Hungary, though small, are sufficient to make that country independent of foreign sources as well as to supply small quantities of ore for export.

Total probable manganese ore reserves of Hungary were estimated at 16 million tons in 1952. The most important deposit is at Urkut in western Hungary, about 15 miles north of Lake Balaton. Proven reserves at this deposit were estimated in 1952 at 1 million tons plus probable reserves of some 10 million more. Manganese content of the ore ranges between 22 and 25 percent. 135/ A railroad

spur connects the Urkut mine and plant to the main line station of Ajka.

A deposit at Epleny, about 15 miles northeast of Urkut, also is being exploited. Ore reserves at Epleny were estimated in 1930 at half a million tons of roughly 28-percent ore, but due to heavy wartime exploitation by the Germans, and later by the Hungarians and Russians, the deposit is nearing depletion. 136/ Evidence obtained by prospecting indicates the presence of low-grade ores (containing 8 to 20 percent manganese) in the Bukk Mountains area, northern Hungary. This deposit is reported as containing 6 million tons of ore. 137/

Estimates of manganese ore reserves in Hungary, as of 1952, are given in Table 14. Manganese content is as indicated above.

Table 14

Estimated Reserves of Manganese Ore in Hungary
1952

Metric Tons

		1952			
	1930 a/	Proven	Probable	Possible	Total
Urkut 138/	4,000,000	1,000,000	10,000,000	3,000,000	14,000,000
Epleny	500,000	100,000	N.A.	N.A.	100,000
Bukk Mountains	6,000,000	N.A.	6,000,000	N.A.	6,000,000
Total	10,500,000	1,100,000	16,000,000	3,000,000	20,100,000

a. All categories.

Most of the ore at Urkut does not meet requirements for ferromanganese production. Concentration is therefore necessary. Manganese recovery through concentration is only 55 percent of the raw ore. 139/

With the aid of Soviet geologists, prospecting for new

reserves of manganese ores has been continuous in Hungary, with new findings of unknown quality or extent reported in the Transdanubian Mountains. 140/

B. Production.

Manganese ore production in Hungary is small in comparison with the USSR, India, or the Gold Coast, but is large by European standards. During a 20-year period, 1918 to 1938, inclusive, Hungary produced 200,283 tons of manganese ore, an annual average production of over 10,000 tons. Output during this period ranged from none in 1921 to 46,209 tons in 1938. 141/

Hungarian manganese was of great importance to the German war machine, and through forced exploitation, 106,800 tons of ore were mined at the Urkut and Epleny deposits in 1943. 142/

Following World War II, manganese production under Soviet supervision decreased while the industry was being reconditioned. By 1947, production of concentrates and ore had again reached sufficient levels to satisfy domestic manganese requirements plus a small surplus for export. Facilities for making ferromanganese, however, were inadequate, and ferromanganese had to be imported. Estimated production of manganese ore and concentrates in Hungary, 1946-55, is shown in Table 15.

Table 15

Estimated Production of Manganese Ore and Concentrates in Hungary *
1946-55

Metric Tons

Year	Urkut (40 Percent Mn) a/	Epleny (28 Percent Mn) b/	Total
1946	14,780 143/	5,220	20,000 144/
1947	33,470 145/	6,530	40,000 146/
1948	30,000 147/	10,000 148/	40,000 149/
1949	30,750	10,250	41,000

* Footnotes for Table 15 follow on p. 43.

Table 15

Estimated Production of Manganese Ore and Concentrates in Hungary
1946-55
(Continued)

Metric Tons

Year	Urkut (40 Percent Mn) a/	Epleny (28 Percent Mn) b/	Total
1950	31,500	10,500	42,000
1951	32,250	10,750	43,000
1952	33,000	11,000	44,000
1953	33,750	11,250	45,000
1954	34,500	11,500	46,000
1955	35,250	11,750	47,000

a. Urkut production is reported as concentrates of 40-percent Mn content. Concentration capacity is 28,000 tons per year on an 8-hour day basis but could be increased, as it was in 1947 and 1948.
b. Epleny production, 1949 to 1955, has been calculated from the 1948 percentage of total production.

The Urkut deposits are mined by means of underground shafts (about 50 meters deep) and galleries (about 100 meters long). A nearby hydroelectric plant furnishes power for mining operations. 150/ The number of workers employed at Urkut was 560 in 1949. 151/ Mined ore at Urkut is sent to a modern ore dressing plant located within the mining area for treatment in "trommel" (drum) washers. 152/ Capacity of washing equipment is 32 tons of crude ore per hour, which, on the basis of one 8-hour shift per day 300 days per year, permits an annual production of approximately 28,000 tons of washed ore. 153/ The ratio of raw ore to concentrates is approximately 3 to 1. 154/

One of the major problems encountered in production is the large loss of manganese in the sands and slimes during the concentration process. The Hungarians plan to install the necessary cyclone equipment for large-scale operations at Urkut, but whether it has been completed or even begun is unknown at the present time. 155/ Successful application of hydro-cyclones will give an additional recovery of 15 to 20 percent, or a total of 70 to 75

percent of the manganese content of the raw ore. Attempts to dry and agglomerate the slimes for blast furnace charging have proved only moderately successful. 156/

Mine production at the Epleny deposit averaged about 1,000 tons of ore per month during the season 1949. It is not likely that any increase was scheduled for this deposit in subsequent years, as it is nearly depleted. All commercial-grade ores at Epleny are run-of-the-mine containing 20 to 30 percent manganese. Production here is seasonal, since the majority of the mining is on the surface and climatic conditions during the winter prevent a continuous operation. According to the last available data (1949), 56 miners were working the ore body. Ore mined at Epleny is shipped by rail to the iron and steel plants at Ozd. 157/

Unless the Hungarians are able to locate and develop new sources of manganese, or find a way to exploit successfully the low-grade Bukk Mountain ores, the closing of Epleny will leave the Urkut deposits as the only active manganese mine in Hungary.

C. Trade.

Hungarian imports of manganese ore are believed to be limited to a few hundred tons of high-grade metallurgical and chemical ores.

Quantitative data on Hungarian exports of manganese ore are not available after 1951. Although exports have never been large, current production would indicate that present export volume may be larger than it was in earlier years. Table 16 gives estimated exports of manganese ore from Hungary, 1948-51.

Table 16

Estimated Exports of Manganese Ore from Hungary
1948-51

Metric Tons

Year	Austria	East Germany a/*	Italy	Total
1948	10,000 158/	1,201 159/		11,201
1949		1,200 160/	5,000 161/	6,200

* Footnote for Table 16 follows on p. 45.

Table 16

Estimated Exports of Manganese Ore from Hungary
1948-51
(Continued)

Metric Tons

Year	Austria	East Germany a/	Italy	Total
1950				
1951	5,623 162/	1,980 163/	1,820 164/	9,423

a. An unknown amount of manganese ore was included in the 1953 East German-Hungarian Trade Agreement.

D. Consumption.

The present level of pig iron production in Hungary requires approximately 12,000 tons of manganese ore of 35-percent manganese content, or equivalent. Requirements of ferromanganese for the Hungarian iron and steel industry range between 6,000 and 9,000 tons annually for the period 1950 to 1955. Prior to 1950, ferromanganese to the extent of 3,500 tons was produced at the Ozd iron and steel works. An increased production of steel and consequent increased requirements for pig iron have reduced the blast furnace capacity available for the production of ferromanganese. 165/

The Hungarian First Five Year Plan proposed construction of facilities to smelt ferromanganese near the Urkut deposit. 166/ Action was not taken on the project. A 1953 report states that a ferromanganese blast furnace was under construction at the new Stalinvaros metallurgical plant at Dunapentele, just east of Budapest. 167/

To help meet the developing shortage of ferromanganese, the USSR agreed to supply 2,000 tons during 1951. 168/ Instructions were also given to Hungarian commercial representatives in other countries for its purchase. It is believed that Hungary continues to import ferromanganese and exports a large share of its ore production. Apparent consumption of manganese ore by the iron and

steel industry in Hungary, 1950-55, is shown in Table 17.

Table 17

Apparent Consumption of Manganese Ore
by the Iron and Steel Industry in Hungary a/
1950-55

Year	Pig Iron		Ingot Steel		Total	
	Ore (35 Percent Mn)	Metallic Content	Ore (35 Percent Mn)	Metallic Content	Ore (35 Percent Mn)	Metallic Content
1950	8,202	2,871	17,000	5,950	25,202	8,821
1951	8,685	3,040	17,000	5,950	25,685	8,990
1952	9,168	3,209	17,531	6,136	26,699	9,345
1953	9,651	3,378	18,591	6,507	28,242	9,885
1954	11,582	4,054	20,185	7,065	31,767	11,119
1955	13,514	4,730	21,248	7,437	34,762	12,167

a. For methodology, see Appendix B.

V. Rumania.

A. Resources.

Manganese ore reserves in Rumania are not large but are sufficient to supply its iron and steel industry for many years. The deposits of industrial importance, as indicated by previous development, are found in the Eastern Carpathian Mountains and the Banat region to the west.

The best deposits, 18 in number, are in the Carpathian Mountains, primarily in the raion of Vatra Dornei in the Suceava Region. Main areas of operation are near the towns of Sarul Dornei (47°18'N - 25°22'E), Vatra Dornei (47°22'N - 25°21'E), and Iacobeni (47°26'N - 25°18'E). The ore, psilomelane, rhodochrosite, and rhodonite, is associated with black quartzites in small irregular pockets in intensive folded structures. Manganese content of the ore ranges from 15 to 45 percent. The average content of shipped ore is 36 percent. 169/

In the Banat region, manganese is found in combination with iron ores near the towns of Delinesti (45°23'N - 22°05'E), Apahida (46°49'N - 23°45'E), and Tarnova (45°21'N - 22°01'E) in the Recita Raion, and at nearby Ohaba (46°05'N - 23°47'E), Caransebes Raion, Timisoara region. The ore ranges from 13 to 26 percent manganese and averages 14 percent iron. 170/

Several other iron-manganese deposits of lesser importance are scattered along the border of Arad and Hunedoara regions in Transylvania, approximately 50 to 60 kilometers north-northwest of the iron and steel center of Hunedoara, and in north Transylvania, near Razoare (47°26'N - 23°46'E), Targul-Lapusului Raion, and Durusa, Baia Mare Raion (47°40'N - 23°35'E), Baia Mare region.

Published estimates of Rumania's total reserves have been superficial since 1931 and should be accepted with caution. Estimated 1952 reserves of manganese ore in Rumania are shown in Table 18.

Table 18

Estimated Reserves of Manganese Ore in Rumania
1952

Thousand Metric Tons

Area	Region	Ore Analysis, Percent: Manganese	Iron	Silica	Estimated Reserve 171/
Carpathian Mountains	Suceava	15 to 45	10	11	650
Banat	Timisoara	14 to 26	12 to 14	18 to 24	1,200
South Transylvania (Codrului, Bihor, Zarandulue Mountains)	Arad and Hunedoara	27 to 48	9 to 21	0.4 to 0.7	1,000
North Transylvania	Baia Mare	24 to 30	20 to 22	15 to 16	1,500
Total					4,350

B. Production.

Manganese requirements of the Rumanian iron and steel industry are small. Manganese production is normally based upon an export market, Poland, Czechoslovakia, and East Germany being the principal recipients.

Following World War II, production increased steadily to 67,800 tons in 1949. Since that year, no official information on the subject has been made available. 172/ Estimated production of manganese ore, in Rumania, 1935-54, is shown in Table 19.

Table 19

Estimated Production of Manganese Ore in Rumania
1935-54

Metric Tons

1935	19,795 173/	1943	38,179 181/
1936	33,856 174/	1944	6,600 182/
1937	50,749 175/	1945	N.A. 183/
1938	60,256 176/	1946	18,807 184/
1939	41,546 177/	1947	30,000 185/
1940	35,358 178/	1948	50,667 186/
1941	15,000 179/	1949	66,816 187/
1942	35,000 180/	1950-54	70,000 a/

a. Substantive data for both production and exports are lacking for this period, but the rate of postwar increases and reports that several mines were mechanized and meeting their planned goals and that trade is being engaged in are indicative that minimum production is somewhere near the reported figure.

It has been estimated that 80 percent of the country's total production comes from the raion of Vatra Dornei, in the Carpathian Mountains. 188/ Several of the more important mines are the Arcita and Fundul Moldovei near Iacobeni, and the Terezia, Dealul Rusului, and Filimon Sarbu, near Vatra Dornei.

The ore is usually mined on the surface and hand-sorted before shipment. Appropriations for the 1949 economic plan included the completion of a concentration plant at Iacobeni. 189/ If the plant was constructed as stated, it is the only known manganese-ore processing plant in Rumania. Altogether, about 800 workers are employed in the Vatra Dornei Raion.

There is no information on the production of the manganese-iron ores of the Banat region except that in 1940, 6,000 tons were mined near Delinesti for consumption at the Recita iron and steel plant. 190/ Production of the low grades in the South Transylvania area may be consumed in the furnaces at Hunedoara.

The small degree of mechanization and the premium on skilled labor are limitations of the manganese ore industry. A mechanization program was initiated at the Arcita mines near Iacobeni and at those in the vicinity of Vatra Dornei, but it consisted mainly of supplying the mines with several air compressors, rock drills, cranes, rails, and the like -- that is, with basic mining equipment. Haulage is done primarily with draft animals. 191/

C. Trade.

Manganese ore has been imported into Rumania through the Black Sea port of Constanta since 1952, probably for transshipment. The country of origin in most cases has been India. Czechoslovakia purchased small quantities of Indian manganese during 1950 and 1951 and may be the ultimate destination of the ore unloaded at Constanta. Hungary also probably imports high-grade ores to supplement the low-grade indigenous product. A total of 16,215 tons of ore shipped to Constanta from China during 1952 probably also moved through to either Czechoslovakia or Hungary.

Rumania exports manganese ore to Poland, Czechoslovakia, and possibly to other Satellite countries. 192/. Although reported exports account for only a small percentage of total ore produced, estimated exports are believed to be as high as one-half to two-thirds of total production. Table 20* shows reported imports of manganese ore by Rumania, 1952-54.

* Table 20 follows on p. 50.

Table 20

Reported Imports of Manganese Ore by Rumania
1952-54

Metric Tons

Year	Country of Origin: China	India	Portugese India	Total
1952	16,215 193/	15,087 194/		31,302
1953		7,000 195/	8,000 196/	15,000
1954		7,500 197/		7,500

D. Consumption.

It is not known to what extent local manganese ores are utilized by the Rumanian iron and steel industry or if part of blast-furnace capacity is being allocated to the production of manganese alloys.

Rumania's ferromanganese requirements are small. It is likely, therefore, that in order to conserve blast-furnace capacity for pig iron production, ferromanganese requirements are imported. If this is true, the entire production of Rumania, with the exception of the low-grade manganese-iron ores of Western Rumania, is available for export. The low-grade manganese ores, which constitute 20 percent of domestic production, will probably continue to be blended with iron ore for the smelting of pig iron.

There is no factual information on the amount of manganese consumed by the Rumanian iron and steel industry. Apparent consumption has therefore been based on requirements. Apparent consumption of manganese ore by the iron and steel industry in Rumania, 1950-55, is shown in Table 21.*

* Table 21 follows on p. 51.

Table 21

Apparent Consumption of Manganese Ore
by the Iron and Steel Industry in Rumania a/
1950-55

Metric Tons

Year	Pig Iron		Steel		Total	
	Ore (35 Percent Mn)	Metallic Content	Ore (35 Percent Mn)	Metallic Content	Ore (35 Percent Mn)	Metallic Content
1950	4,342	1,520	5,523	1,933	9,865	3,453
1951	5,308	1,858	5,948	2,082	11,256	3,940
1952	5,308	1,858	6,585	2,305	11,893	4,163
1953	5,791	2,027	7,437	2,603	13,228	4,630
1954	6,757	2,365	8,500	2,975	15,257	5,340
1955	7,142	2,500	9,560	3,346	16,702	5,846

a. For methodology, see Appendix B.

VI. Bulgaria.

A. Resources.

Bulgaria's manganese ore reserves are negligible and are scattered in small deposits throughout the country. In 1944, visible and probable ore reserves were given as 100,000 tons. No estimates of "possible ore" were made at that time. 198/ Postwar surveys may have brought about a minor increase of mineable reserves. Otherwise, continuous production would have greatly reduced the 100,000-ton reserve figure. No new discoveries, however, have been reported.

Content of Bulgarian manganese ore ranges from 20 to 60 percent manganese, 1 to 8 percent iron, and 7 to 12 percent silica. The greatest portion of the ore is of relatively low grade -- 20 to 35 percent manganese.

Many of the deposits are too small to be exploited economically. Of principal importance are the Pozarevo (42°45'N - 23°09'E) and Golem Rakovitsa (42°36'N - 23°48'E) deposits in the vicinity of Sofiya, Sofiya Okoliya; the Mecka (42°31'N - 24°03'E) and Panagyurishte

(42°30'N - 24°10'E) deposits near the city of Panagyurishte, Plovdiv Okoliya; the Byala deposit (42°53'N - 27°54'E) south of Varna on the Black Sea coast, Varna Okoliya; and a deposit near the town of Yambol (42°28'N - 26°31'E), Yambol Okoliya. Bulgarian manganese ore deposits are described in detail in the separate annex, available in typescript to authorized persons.

B. Production.

Annual production of manganese ore in Bulgaria averaged 600 tons from 1902 to 1940. During the German occupation in World War II, annual production varied from 4,000 to 10,000 tons. The principal mines worked by the Germans were the Pozarevo and Byala. 199/

After the war, most of the mines ceased operations, but later they were gradually restored to the estimated present level of from 25,000 to 30,000 tons per year. Actual production appears to be in line with state planning. 200/

C. Trade and Consumption.

Bulgaria has no iron and steel industry other than a small plant now under construction. Manganese ore is exported principally to Poland, East Germany, Austria, and Italy. Poland is the largest consumer. Estimated production and reported exports of manganese ore by Bulgaria are shown in Table 22.

Table 22

Estimated Production and Reported Exports of Manganese Ore by Bulgaria
1950-55

Metric Tons

Year	Production a/	Reported Exports
1950	11,000 201/	200 202/
1951	12,000 203/	206 204/
1952	20,000	24,600 205/
1953	25,000	20,000 (Plan) 206/ b/
1954	30,000	N.A.
1955	30,000	

a. 1952 to 1955 production is based on 1952 and 1953 exports.
b. Poland.

Completion of the Lenin Metallurgical Plant at Dimitrovo in 1957 will give Bulgaria its first steel plant. 207/ At that time, several thousand tons of ore will be required to supply the plant with the necessary manganese for a yearly steel production of 250,000 ingot tons.

VII. Czechoslovakia.

A. Resources.

The only known manganese ore in Czechoslovakia is a low-grade manganiferous ore averaging 17 percent manganese. Two areas of industrial importance are the Svabovce-Kisovce deposits near Poprad (49°03'N - 20°18'E), in eastern Slovakia, and the Chvaletice deposit (50°02'N - 15°26'E) just west of Pardubice, in eastern Bohemia. Data on total reserves are not available, but reserves are considered small.

Both the Svabovce and Kisovce mines work the same ore bed. Mining operations are underground. The mined ore, containing 17 percent manganese and 3 percent iron, is shipped on the nearby Kosice-Bohemian railway to the iron and steel plants at Moravska and Trinec. 208/

The Chvaletice deposit consists of irregular masses of sedimentary manganese containing 15 to 20 percent manganese and 15 to 20 percent iron. The ore is mined from the surface and is shipped to plants in Kladno and Kraluv Dvur in Bohemia. 209/ Some confusion exists as to whether the flotation plant found in the Chvaletice area is used in connection with the concentration of manganese ore or of pyrites, which are mined close by. There is no evidence of concentration of manganese ore in Czechoslovakia. It is believed, therefore, that the flotation plant is attached to the pyrites mine.

Other areas in Czechoslovakia reported as containing manganese minerals are as follows:

Pezinok 210/ (48°17'N - 17°16'E)	Near Bratislava	Went into operation March 1952.
Kutna Hora and Pribram 211/ (49°13'N - 17°00'E)	Near Kolin	Opened in May 1952. Closed several months later.

Setich 212/ (48°04'N - 18°49'E)	Near Chrudim	Went into operation November 1951.
Klabava, Ejpovice, and Blatna 213/ (49°26'N - 13°53'E)	Near Cheb	In operation.

Production from these mines is considered negligible.

B. Production.

Production of manganese ore in Czechoslovakia has consistently failed to meet planned targets. The greatest difficulty stems from the Svabovce-Kisovce mines, where such conditions as obsolete mining equipment, numerous mine accidents, and labor dissatisfaction prevail. These mines, worked by 750 miners, produce approximately 92 to 95 percent of total production. 214/ Introduction of the norm system during the fall of 1952 does not appear to have corrected production lags. 215/ This was brought out by the industry's failure to meet planned targets for both 1952 216/ and 1953. 217/ Planned and estimated production of manganese ores in Czechoslovakia is shown in Table 23.

Table 23

Planned and Estimated Production of Manganese (17 Percent Mn) Ores in Czechoslovakia a/* 1949-55

Thousand Metric Tons

Year	Bohemia and Moravia 218/	Slovakia 219/	Total	Estimated 220/ Actual Production
1949	11	165	176	130
1950	13	170	183	170
1951	14	190	204	180
1952	15	230	245	230
1953	15	250	265	240
1954	15 b/	250	250 b/	
1955	15 b/	250	250 b/	

* Footnotes for Table 23 follow on p. 55.

Table 23

Planned and Estimated Production
of Manganese (17 Percent Mn) Ores in Czechoslovakia a/
1949-55
(Continued)

a. No data are available after 1953. Due to a slight relaxation of the rigid economic plans and to Czechoslovakia's continuous failure to meet previous production quotas, it is believed that production plans for 1954 and 1955 will have little change over the 1953 plan.
b. Estimated.

Future production of manganese ore is not likely to increase much over present levels until mining operations become more mechanized and the miners more cooperative. Apparently the installation of conveyor-belt systems, ore and rock loaders, and other mine equipment which was planned as far back as 1951 for the Svabovce-Kisovce mines has not been completed. 22/ More mechanized operations may also improve the attitude of the miners.

C. Trade and Consumption.

Domestic production of manganese ore falls considerably short of apparent consumption. All of the metallurgical-grade ore, approximately 35 percent of total requirements, must be imported by rail, largely from the USSR.

Czechoslovakia also imports 10,000 to 15,000 tons of ore from non-Soviet Bloc countries, but it is believed that these shipments are based on trade considerations rather than on unavailability of Soviet ore. Czechoslovak industry formerly enjoyed a large Western market for such items as glassware, ceramics, and shoes; but with the industry's assimilation into the Soviet Bloc, these markets have been closed. Disposal of these items in such countries as India, Turkey, Egypt, and Burma requires acceptance of the commodities these countries offer or acceptance of payment in local currencies.

Czechoslovakia has exported small quantities of ore in the past, but this is not a normal practice. Years of reported exports

were 1938, 1939, and 1948, when 980 tons, 4,560 tons, and 8 tons, respectively, were shipped to Poland. 222/

Virtually all manganese ore is used in the iron and steel industry. Small quantities of imported ore are consumed in the manufacture of dry cells and in chemicals. Planned consumption of domestic production, imports, and apparent consumption of manganese ore by Czechoslovakia are shown in Table 24. 223/

Table 24

Planned Consumption
of Domestic Production, Imports, and Apparent Consumption
of Manganese Ore by Czechoslovakia
1949-55

Thousand Metric Tons

Year	Planned Consumption of Domestic Production	Imports	Apparent Consumption a/
1949	170	81	251
1950	170	87	257
1951	170	89	259
1952	210	97	307
1953	260	107	367
1954			378 b/
1955			400 b/

a. No data are available on planned consumption after 1953. Consumption of manganese for 1954 and 1955 had been based on estimated steel production increases, 3 and 6 percent, respectively, for the same years. A normal correlation usually exists between these two items.
b. Estimated.

Czechoslovakia will never be sufficient in manganese ore if steel production is to be maintained at present levels. The ore reserves are not considered large, the grade is low, and all profitable operations are believed to be developed. It appears that the USSR will continue to supply the greatest portion of future manganese

requirements.

VIII. Poland.

A. Trade.

There are no manganese ore deposits in Poland. 224/ The USSR is Poland's most important source for metallurgical-grade ores. Low-grade manganese ore shipments for the production of spiegeleisen and pig iron probably originate in Bulgaria, Rumania, and Hungary. Spot shipments of manganese ores have also been reported from France, India, and Iran. On several occasions, Soviet ore shipments to East Germany were unloaded at the Polish Baltic ports of Gdynia and Stettin for transshipment. Planned imports as shown in Table 25 are considerably below Poland's total manganese ore requirements (see Table 26) and probably are limited to metallurgical-grade ores from the USSR. Polish imports of manganese ore are shown in Table 25.

Table 25

Imports of Manganese Ore by Poland
1949-54

Metric Tons

Year	USSR	Other Countries	Total Tabulated Shipments a/	Reported Annual Imports	Planned Imports
1949	41,000 225/	4,500 226/	45,000	144,000 227/	N.A.
1950	54,550 228/	6,935 229/	61,485	92,000 230/	65,000 231/
1951	43,775 232/	1,930 233/	45,704	76,000 234/	65,000 235/
1952	34,447 236/	17,257 237/	51,704	86,700 b/ 238/	80,000 239/
1953	30,300 240/	20,000 241/ (Planned)	30,300	N.A.	160,000 c/ 242/
1954	106,000 b/ 243/	N.A.	106,000	N.A.	N.A.

a. Soviet shipments include only ore from the Chiatura deposit in Georgia SSR. Ore from the Nikopol' deposits in the Ukraine is shipped overland by rail and cannot be accounted for. In 1951, total shipments of Nikopol' ore were reported to be 48,000 tons. Other information implies that Nikopol' ore constitutes approximately one-half of Poland's imports.
b. January to October imports.
c. Indications are that Poland exported 25,000 to 30,000 tons of manganese ore as ferro-manganese. The balance of the planned surplus of imports may be for stockpiling.

B. Consumption.

The use of low-grade manganese ores in Polish blast furnaces varies according to the amount of open-hearth slag added to the charge and the desired manganese content of the open-hearth pig iron.

In 1952, low-grade manganese ore consumed per ton of open-hearth pig iron amounted to 84 pounds of ore or 25.2 pounds of metallic manganese. Consumption per ton in 1953 was estimated to be approximately at the same rate as 1952, but in 1954 the rate was to be increased to 116 pounds of ore per ton of open-hearth pig iron, the amount of open-hearth slag included in the charge being reduced from 201 pounds to 79 pounds per ton of open-hearth pig iron. This change in charging practice was made to raise the manganese content of open-hearth pig iron from 1.2 percent to 1.7 percent. 244/ Important plants in Poland producing pig iron are Pokoj, at Nowy Byton: Florian, at Swietochlowice; Dzierzynski, at Dabrowa-Gornicza; Kosciuszko, at Chorzow; and Bobrek and Szczecin, both in cities of the same names.

There is nothing to indicate that consumption of manganese ferro-alloys in the production of steel deviates from the normal input of 5 to 7 kilograms per ton of steel. On this basis, production of manganese ferro-alloy is greater than the amounts required by the Polish iron and steel industry. It is believed, therefore, that part of Poland's manganese ferro-alloy production is shipped to other Satellite nations. The high ratio of spiegeleisen production to ferromanganese production may also indicate that in many instances spiegeleisen is being substituted for higher cost ferromanganese when making steel. Substitution in this case would increase the amount of ferromanganese that could be exported. There is no information on the production of silicomanganese. Principal Polish plants producing ferromanganese and spiegeleisen are Pokoj at Nowy Byton, Kosciuszko at Chorzow, Bieruta at Czestochowa and Bobrek in the city of the same name. Production of ferromanganese and spiegeleisen for the years 1949-54 is shown in Table 26.*

* Table 26 follows on p. 59

Table 26

Apparent Consumption of Manganese Ore
by the Iron and Steel Industry in Poland
1949-54

Thousand Metric Tons

	1949	1950	1951	1952	1953	1954
Planned Production of Ferromanganese (75 percent Mn)	21.0 245/	20.0 246/	28.0 247/	35.0 248/	40.0 249/	40.0 250/
Actual Production of Ferromanganese, Jan -July a/*	N.A.	13.5 251/	22.1 252/	18.0 253/	18.9 254/	N.A.
Manganese Ore Required for Ferromanganese (48 percent Mn)	42.0	40.0	60.0	70.0	80.0	80.0
Metallic Manganese Required for Ferromanganese	20.1	19.2	28.8	33.6	38.4	38.4
Planned Production of Spiegeleisen (22.5 percent Mn)	30.1 255/	17.5 256/	25.0 257/	33.5 258/	30.0 259/	32.0 260/
Actual Production of Spiegeleisen a/	N.A.	7.5 261/	13.7 262/	10.8 263/	12.5 264/	N.A.
Manganese Ore Required for Spiegeleisen (30 percent Mn)	30.1	17.5	25.0	33.5	30.0	32.0
Metallic Manganese Required for Spiegeleisen	9.0	5.3	7.5	10.1	9.0	15.4
Pig Iron Production 265/	1,250.0	1,500.0	1,600.0	1,800.0	2,000.0	2,100.0
Manganese Ore Required for Pig Iron (30 percent Mn) 266/	47.6	57.1	61.0	68.6	76.2	115.2
Metallic Manganese in the Form of Ore Required for Pig Iron b/	14.3	17.1	18.3	20.6	22.9	34.6
Apparent Total Consumption of Manganese Ore c/	119.7	114.6	146.0	172.1	186.2	227.2
Apparent Total Consumption of Metallic Manganese d/	43.4	41.6	54.6	64.3	70.3	88.4

* Footnotes for Table 26 follow on p. 60.

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Table 26

Apparent Consumption of Manganese Ore
by the Iron and Steel Industry in Poland
1949-54
(Continued)

Thousand Metric Tons

a. Figures are for the January to July period. Annual totals are not available; mid-year rates of production would indicate that most targets were met.
b. Metallic manganese input for the years 1949-1953 was estimated on the basis of 25.2 pounds per ton of pig iron and for 1954, 36.3 pounds per ton of pig iron.
c. Manganese ore required for ferromanganese, spiegeleisen, and pig iron.
d. Metallic manganese required for ferromanganese, spiegeleisen, and pig iron.

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IX. East Germany.

A. Production.

The only deposit in East Germany reported to be producing ore containing manganese is at Schmalkalden (50°43'N - 10°27'E) in the Thuringia region. 267/ The quality of the product is not known, except that the ore is probably a manganiferous iron ore (5 to 10 percent Mn). 268/ Later it was reported that the relatively high iron content of the ore has caused the operation to assume more importance as a source of iron ore than of manganese. 269/

B. Trade.

Immediately after World War II, East Germany used Nikopol' ore which the Germans had shipped in during their occupation of the Ukraine. 270/

During the period from 1948 to 1950, stocks of manganese ore and ferromanganese were critical in East Germany. The shortage was partially alleviated by the importation of 21,200 tons of concentrated ore from Hungary and the USSR. 271/

In order to insure the country's iron and steel industry against further shortages of manganese ore, East Germany's Five Year Plan (1951-55) called for ore imports in excess of requirements. 272/ The USSR is supplying most of the ore, with small tonnages coming from Hungary, Rumania, and Bulgaria. Planned imports and apparent consumption of manganese ore by East Germany, 1950-55 are shown in Table 27.*

Although it cannot be ascertained definitely, indications are that East Germany is importing the total amount of ore called for in the Plan. The 25,000 tons to be imported from the USSR in 1950 were realized: 20,000 tons were received during the first 8 months of 1951, and shipments reported through the Frankfurt/Oder gateway for the last 9 months of 1952 totaled 88,000 tons. 273/ This rate of import for the entire years of 1951 and 1952 would have resulted in approximate plan fulfillment.

East Germany also engages in a small ferromanganese trade. Several thousand tons are imported annually, mostly from the USSR. An East German-West German trade agreement states that East Germany will export ferromanganese to West Germany during 1954. 274/ The quantity, though unknown, is not thought to be large. Planned imports and apparent consumption of manganese ore by the East German iron and steel industry, 1950-55 are shown in Table 27.

* Table 27 follows on p. 62.

Table 27

Planned Imports and Apparent Consumption of Manganese Ore
by the East German Iron and Steel Industry
1950-55

Thousand Metric Tons

	1950	1951	1952	1953	1954	1955
Planned Imports of Manganese Ore from the USSR 275/	25.0 25.0	42.0 42.0	120.0 120.0	180.0 180.0	220.0 220.0	250.0 250.0
Planned Production of Ferromanganese (75 percent Mn)	8.0 276/	5.0 277/	20.0 278/	18.6 279/	N.A.	N.A.
Actual Production of Ferromanganese	8.4 280/	7.8 281/	16.9 282/			
Planned Imports of Ferromanganese		5.0 283/	6.0 284/	7.0 285/		
Manganese Ore Required for Ferromanganese (43 percent Mn)	16.8	15.6	33.8	37.2		
Metallic Manganese Required for Ferromanganese	8.1	7.5	16.2	17.9		
Planned Production of Spiegeleisen (22.5 percent Mn) a/	15.0 286/	30.0 287/	35.0 288/	50.0 289/	50.0 290/	
Manganese Ore Required for Spiegeleisen (30 percent Mn)	15.0	30.0	35.0	50.0	50.0	
Metallic Manganese Required for Spiegeleisen	4.5	9.0	10.5	15.0	15.0	
Pig Iron Production 291/	337.0	341.0	653.0	1,100.0	1,175.0	1,215.0
Est. Manganese Ore Required for Pig Iron (30 percent Mn) b/	7.7	7.7	14.7	24.8	26.3	27.3
Metallic Manganese in the form of Ore Required for Pig Iron	2.3	2.3	4.4	7.4	7.9	8.2
Apparent Total Consumption of Manganese Ore c/	39.5	53.3	83.5	112.0		
Apparent Total Consumption of Metallic Manganese d/	14.9	18.8	31.1	40.3		
Surplus or Deficit of Manganese Ore	-15.5	-11.3	+36.5	+68.0		

* Footnotes for Table 27 follow on p. 63.

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Table 27

Planned Imports and Apparent Consumption of Manganese Ore
by the East German Iron and Steel Industry
1950-55
(Continued)

Thousand Metric Tons

a. Complete statistics on spiegeleisen production are not available. Many times this production is included in pig iron production.
b. For methodology, see Appendix B.
c. Manganese ore required for ferromanganese, spiegeleisen, and pig iron.
d. Metallic manganese required for ferromanganese, spiegeleisen, and pig iron.

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C. Consumption.

East Germany's planned imports of manganese ore from 1952 to 1955 are considerably in excess of the iron and steel industry's requirements. If all the ore is imported according to plan, a surplus of several hundred thousand tons will exist in East Germany. This ore in stockpile form could supply the East German iron and steel industry for several years.

Low-grade manganese ores are sent to the Maxhuette plant at Unterwellenborn, the Calbe plant at Calbe-Saale, and the J. V. Stalin plant at Stalinstadt, formerly Fuerstenberg. All three plants, with the exception of Calbe, produce both pig iron and spiegeleisen. Calbe, the site of the low-shaft blast furnaces in East Germany, does not produce spiegeleisen.

Low-grade manganese ore is included in the blast furnace charge when making pig iron, but the extent of its use or the percent of the charge is unknown. The use of large quantities of manganese-rich slags from the Lippendorf ferroalloy plant and the manganese-rich iron ores from the Schmalkalden deposit, however, reduces the amount of manganese ore normally required in the production of pig iron.

The production of spiegeleisen is divided between two plants, the J. V. Stalin plant being the most important. During 1953, this plant was to produce 43,000 tons of a planned total of 50,000 tons of spiegeleisen. Maxhutte, with its lesser facilities, was to produce the remainder. 292/

Most of the metallurgical-grade ore is sent to the Lippendorf Ferroalloy Plant, which produces all of East Germany's ferromanganese. This electric furnace plant produces not only ferromanganese but also other ferroalloys needed by East Germany. The importation of ferromanganese into East Germany does not necessarily indicate a shortage of this material but indicates, rather, the feasibility of importing a lower quality blast furnace ferromanganese for use when at times a high-quality ferromanganese is not necessary. Exports of ferromanganese will undoubtedly be an electric furnace product.

The 1953 distribution plan for 25,600 tons of ferromanganese -- 18,700 tons from domestic production and 7,000 tons from imports -- was to be distributed to various sectors of the East German industry as follows: 293/ Steel production, 13,169 tons; machine construction, 5,218 tons; SAG plants, 2,756 tons; local industry, 292 tons; coal industry, 185 tons; and miscellaneous consumers, 30 tons. Thus, consuming industries

required only 21,650 tons of the 25,600 tons available, leaving 3,950 tons to be exported or held for future use.

X. Albania.

Manganese ore in the form of pyrolusite is found in the vicinity of the Munela Mountains, in Shkodres Prefecture (42°00'N - 19°45'E). The quality and extent of the ore are not known. No mining has been reported. A small quantity of manganese is associated with the copper pyrite ores of Kaminitza and Rehoova, Korce Prefecture (40°30'N - 20°40'E).294/

In the absence of any iron and steel industry, there is little demand for manganese in Albania. Several tons of chemical-grade ores would be the annual maximum requirement.

APPENDIX A

SOVIET STANDARDS FOR MANGANESE ORES AND MANGANESE FERROALLOYS

Table 28

Losses in Manganese during Smelting of Special and Common Pig Iron According to Soviet Metallurgical Practices

Percent

Product	Volatilize	Absorbed by Pigs	Absorbed by Slags
Ferromanganese	10	75 to 80	10 to 15
Spiegeleisen	5	75 to 80	15 to 20
Foundry Pig Iron	0	70 to 75	25 to 30
Bessemer Pig Iron	0	60 to 70	30 to 40
Martin and Thomas Converter Pig Iron	0	50 to 60	40 to 50
Foundry and Converted Pig Iron on Charcoal	0	40 to 50	50 to 20

Table 29

Standards for Soviet Blast-Furnace Ferromanganese a/

Percent

Grade	Silicon	Manganese	Phosphorus Class A	Phosphorus Class B	Sulfur
FM-1	2.00	Over 75	0.35 b/	0.45 b/	0.03 b/
FM-2	2.00	70 to 75	0.35 b/	0.45 b/	0.03 b/

a. In accordance with the general standards of the USSR (GOST 805-41), blast-furnace ferromanganese is produced in 2 grades: FM-1 and FM-2, each one divided in classes A and B, depending upon phosphorus content.
b. Maximum.

Table 30

Requirements for Manganese Ores and Concentrates
Suitable for the Production of Ferromanganese in the USSR

Percent

Type a/	Manganese	Silica	Ratio Manganese to Iron	Phosphorus
I-A	Over 50	9 b/	6 to 7 c/	0.17 to 0.20 b/
I-B	40 to 50	9 to 15 b/	7 to 10 c/	0.14 to 0.17 b/
II	35 to 40	15 to 25 b/	3 to 4 c/	0.18 b/
III	30 to 35	25 to 35 b/	4 to 5 c/	0.15 b/

a. Type I ores are used for standard-grade ferromanganese.
Types II and III ores are used for ferromanganese in cases of extreme necessity, provided the iron and phosphorus content are low.
b. Maximum.
c. Minimum.

Table 31

Standards for Silicomanganese a/

Percent

Manganese	Iron	Silica
55 to 75	5 to 20	20 to 25

a. There have been no standard grades of silicomanganese established in the USSR. Silicomanganese with the above content has been made in a number of countries.

Table 32

Standards for Spiegeleisen and Silicospiegeleisen in the USSR

Percent

	Manganese	Phosphorus	Silica
Spiegeleisen			
Z-1	20.1 to 25.0	0.22 a/	
Z-2	15.1 to 20.0	0.20 a/	
Z-3	10.0 to 15.0	0.18 a/	
Silicospiegeleisen	18.0 to 24.0	0.20 a/	9.0 to 13.0

a. Maximum.

Table 33

Requirements for Manganese Ores Suitable for the Production of Spiegeleisen and Silicospiegeleisen in the USSR

Percent

Type	Manganese and Iron	Ratio Manganese to Iron	Silica	Phosphorus
I	50 to 60	1.5 to 0.6	15 a/	0.09 to 0.18
II	40 to 50	2.0 to 0.8	15 to 25	0.08 to 0.15
III	30 to 40	2.5 to 1.0	25 to 35	0.07 to 0.12

a. Maximum.

Table 34

Requirements for Ores Suitable for the Production of Manganese Pig Iron in the USSR

Percent

Iron	Manganese	Phosphorus
Over 40	4 to 10	0.05 a/

a. Maximum.

Table 35

Requirements for Manganese Ores Suitable for the Production of Dry Cell Batteries in the USSR a/ 295/

Percent

Manganese Dioxide	Iron	Calcium	Cobalt	Nickel	Arsenic	Copper
80 b/	3.0 b/	3 c/	Traces	Traces	Traces	0.2 c/

a. Pyrolusite ores are most suitable.
b. Minimum.
c. Maximum.

APPENDIX B

METHODOLOGY

Reserves were estimated for most of the countries by taking the most current reserve data available and making the necessary adjustments by adding new discoveries and subtracting past production.

The lack of data for current production necessitated the use of past production figures, published percentages, plans, and -- in some instances -- estimated requirements. Assumptions were made that the Urals and Siberian areas in the USSR were producing sufficient low-grade ores to satisfy local iron and steel mill requirements.

Foreign-trade figures were obtained through the use of reported shipments, trade agreements, and -- in the cases of several of the Satellite countries -- planned imports. Trade estimates cannot be considered complete, and should therefore be used with caution.

Direct consumption figures are lacking. Apparent consumption of manganese ore by the USSR's iron and steel industry was calculated from Soviet furnace practices (see below). Estimates of consumption for some of the other countries required the use of US analogy. In such cases, inputs used were as follows: approximately 14.9 pounds of metallic manganese per metric ton of pig iron and 16.4 pounds of metallic manganese to make the manganese ferroalloys added to 1 ton of steel. This includes metallic loss in manganese ferroalloy smelting but not manganese added to the furnace through the use of charged scrap or slag (see US Bureau of Mines, Materials Survey -- Manganese, October 1952).

For the USSR, figures for manganese (metallic equivalent) required per ton of pig iron, foundry iron, and steel, derived from the typical practice in each area, are set forth in Table 36.* These figures cover the manganese requirement which is derived directly or indirectly from manganese ore and not from any scrap or slag which may be recharged in the furnaces. These figures,

* Table 36 follows on p. 72.

Table 36

Methodology for Deriving Consumption of Manganese in the Iron and Steel Industry in the USSR

Consumer and Raw Material	Source	1953 Production (Metric Tons)		Manganese (Metallic Equivalent) per Tons of Metal Produced (Kilograms)	Practice Used
Steel Plants in the South and Central Areas (Regions I-VII)					
Iron Ores	Krivoy Rog (Region III)				
Coke	Donets (Regions III and IV)				
Manganese Ores	Nikopol' and Chiatura (Regions III and V)				
Manganese Content of Ore 25 Percent		Pig Iron	12,992,000	33	Dneprodzerzhinsk No. 3 296/
Manganese Content of Ore 25 Percent		Foundry Iron	3,248,000	10	Krivoy Rog No. 2 297/
Manganese Content of Ore 48 Percent a/		Steel	20,900,000	6	Soviet Practice 298/
Iron and Steel Plants in the Urals Area (Region VIII)					
Iron Ores	Urals (Region VIII)				
Coke	Kuznetsk and Karaganda (Regions IX and Xa)				
Manganese Ores	Urals and Kazakhstan (Regions VIII and Xa)				
Manganese Content of Ore 25 percent		Pig Iron	7,616,000	16	Magnitogorsk No. 4 299/
Manganese Content of Ore 25 Percent		Foundry Iron	1,904,000	10	
Manganese Content of Ore 33 to 35 percent a/		Steel	12,920,000	6	
Iron and Steel Plants in Kuznetsk Basin (Region IX)					
Iron Ores	Siberia (Region XI)				
Coke	Kuznetsk (Region IX)				
Manganese Ores	Mazul and Usinsk (Region XI)				
Manganese Content of Ore 18 Percent		Pig Iron	2,240,000	13	Kuznetsk No. 4 300/
Manganese Content of Ore 48 Percent a/		Steel	4,180,000	6	

a. Most of this addition is charged in the form of ferromanganese containing 72 to 78 percent manganese.

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multiplied by the tonnage of pig iron, foundry iron, and steel produced in each year and in each area covered in Table 7,* give the figures for manganese requirements shown in that table.

* P. 26, above.

APPENDIX C

GAPS IN INTELLIGENCE

In the field of this report, information is most noticeably lacking on the following topics:

a. The production of manganese concentrates, as distinguished from run-of-the-mine ore. This includes concentrating facilities and capacity.

b. All phases of the manganese industry in the Urals and Siberia. Most of the available information is pre-World War II, which is prior to the principal development of the industry in these areas.

c. All phases of the manganese industry in the Satellite nations. Smallness of the industry in these countries restricts the amount of information that is made available.

d. The kind and quantities of the manganese ferroalloys smelted from the ore. Determination of this would be exceedingly valuable in arriving at more accurate consumption estimates.

e. Intra-Soviet Bloc trade. Ore movements do not involve large tonnages and are ordinarily by rail, which prevents accurate reporting on totals.

d. Stockpiles and consumer stocks.

APPENDIX D

SOURCES AND EVALUATION OF SOURCES

1. Evaluation of Sources.

Information for this report was obtained from numerous sources, of which the following are considered most important:

a. CIA OO and SO sources
b. German documents
c. FDD and FBIS reports
d. Army, Navy, and Air documents
e. Soviet periodicals and journals
f. Prisoner-of-war reports
g. US Government reports, especially Department of State and Department of Interior, US Bureau of Mines.

The CIA and State Department documents were especially helpful in providing current information. US military documents were also helpful in this respect. German intelligence documents, although of pre-1943 date, contributed basic background information. Studies made by the US Bureau of Mines on the manganese industries of these countries provided excellent background and working data. Prisoner-of-war reports were useful for confirmation purposes. FDD translations of Soviet metallurgical texts and trade journals provided much of the key data for determining various aspects of the manganese industry in the USSR.

2. Sources.

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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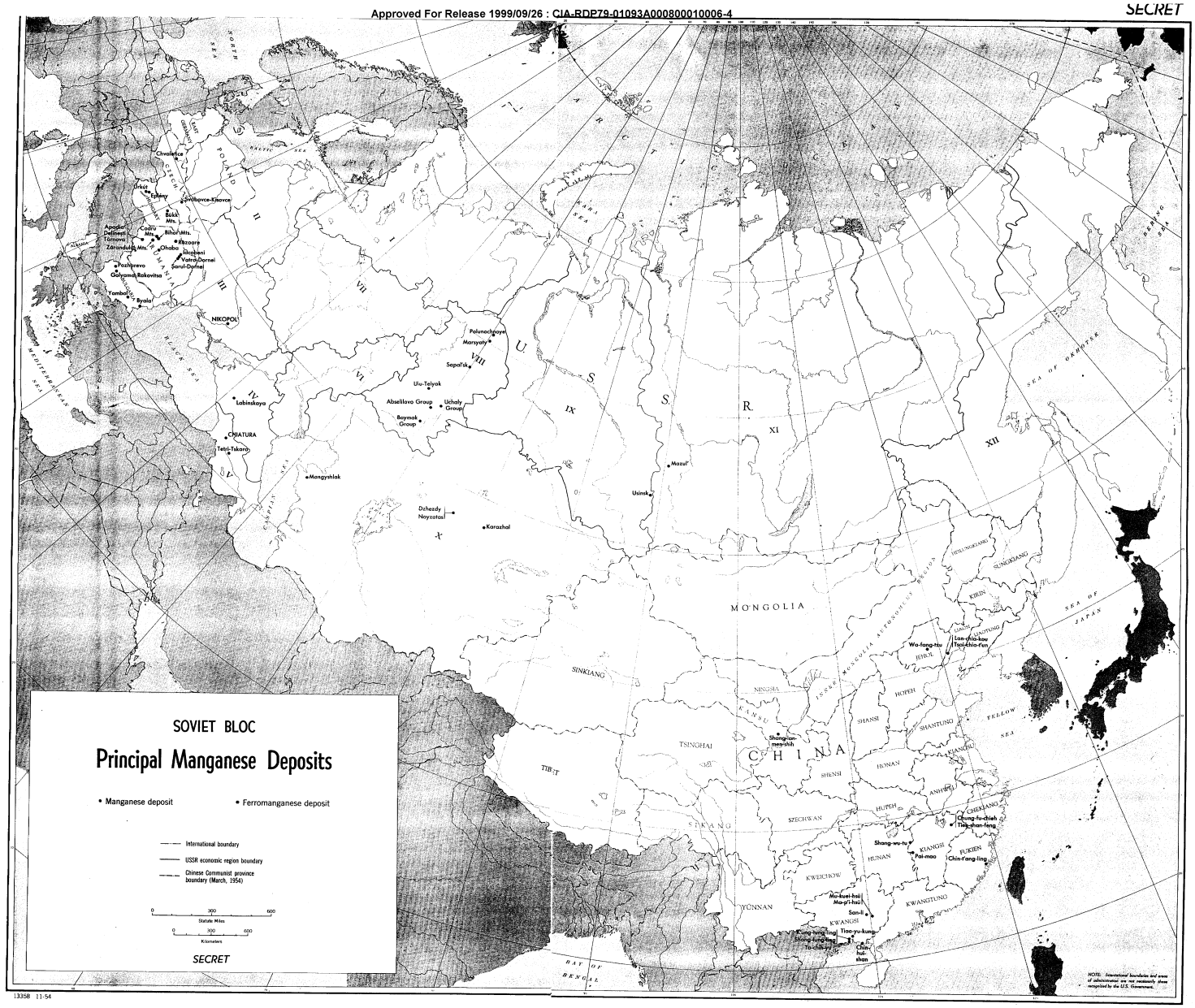

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